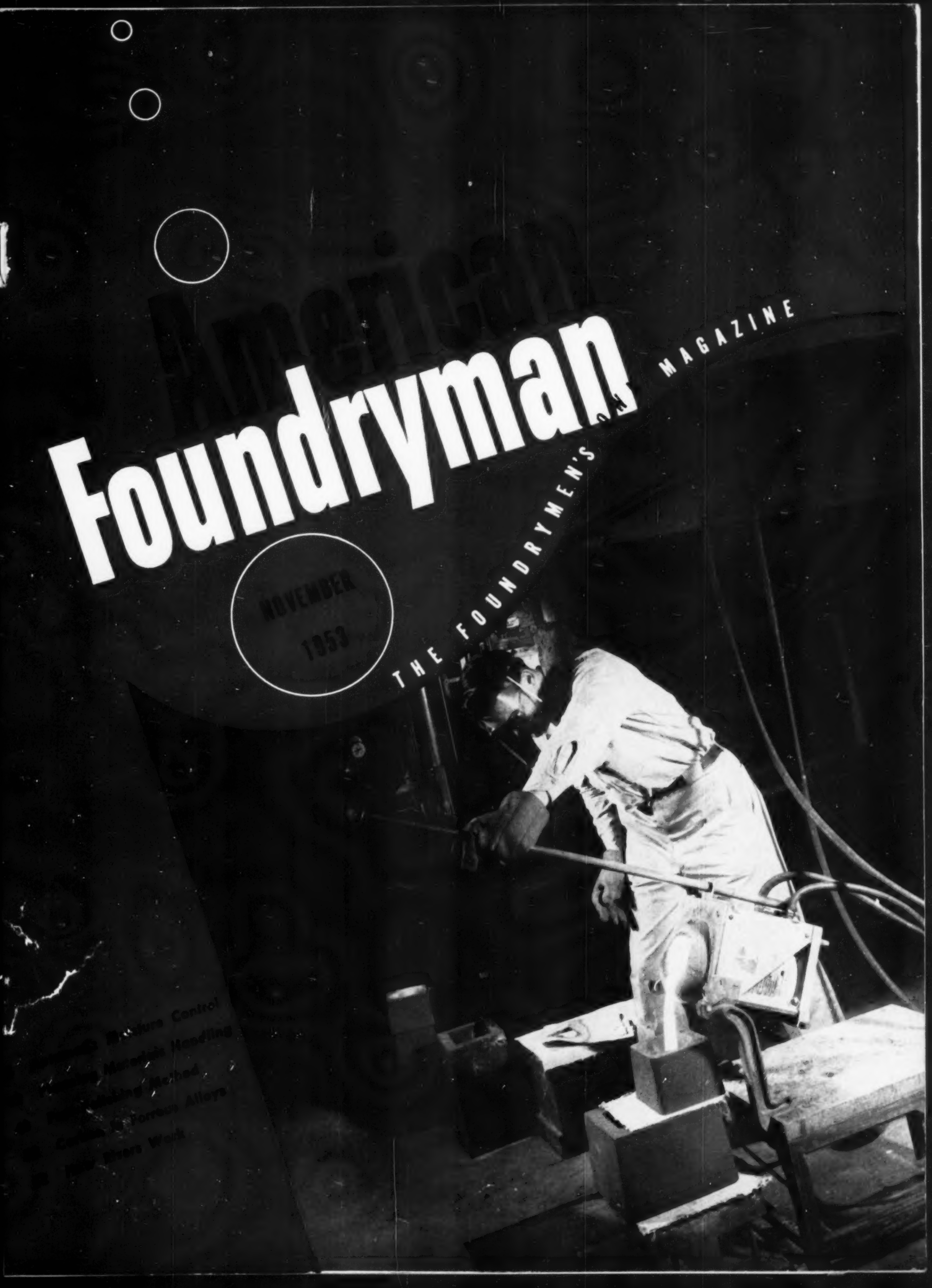
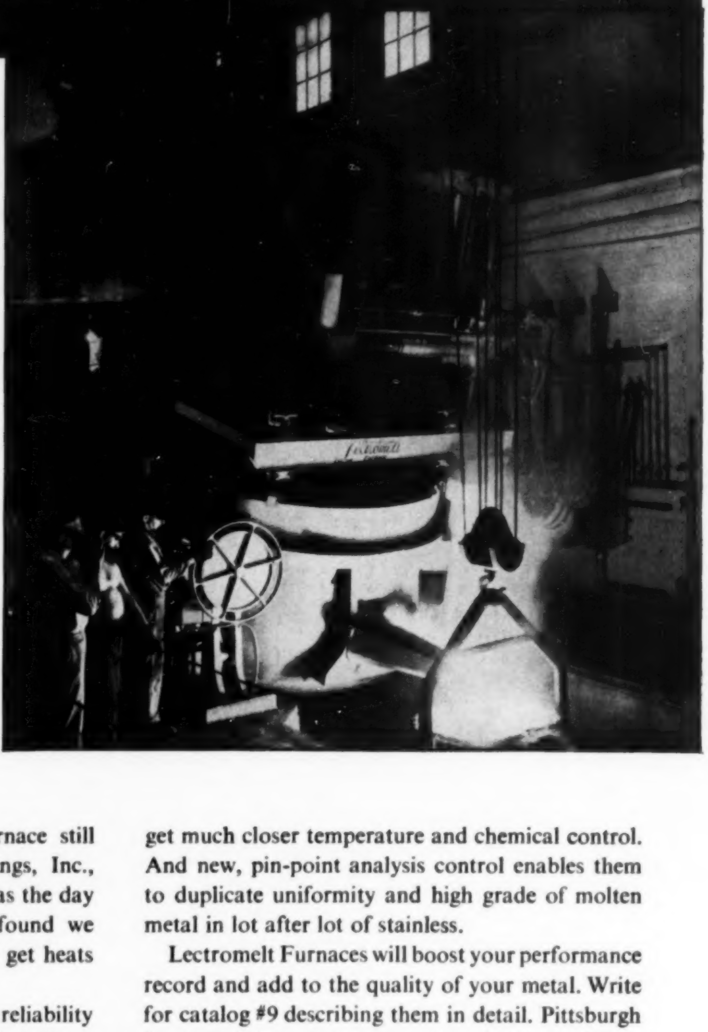

American
Foundryman
THE FOUNDRYMEN'S OWN MAGAZINE
NOVEMBER
1953
Moisture Control
Materials Handling
Method
Ferrous Alloys
Work

if you judge a furnace on performance...

For 32 years Empire Steel Castings, Inc., has depended on this Lectromelt Furnace. Rated at 1½ tons, it consistently pours 2½ to 3-ton heats.

New 5-ton Lectromelt Furnace at Empire pours a high-quality stainless-steel heat.



A rugged, 32-year-old Lectromelt* Furnace still works full time at Empire Steel Castings, Inc., Reading, Pa. Empire says, "It's as good as the day it started. Better, in fact, because we found we could pour additional power to it, so we get heats out faster than we first dared to."

On the basis of the performance and reliability of Empire's old furnace, they recently bought a new 5-ton, top-charging Lectromelt. Now they get much closer temperature and chemical control. And new, pin-point analysis control enables them to duplicate uniformity and high grade of molten metal in lot after lot of stainless.

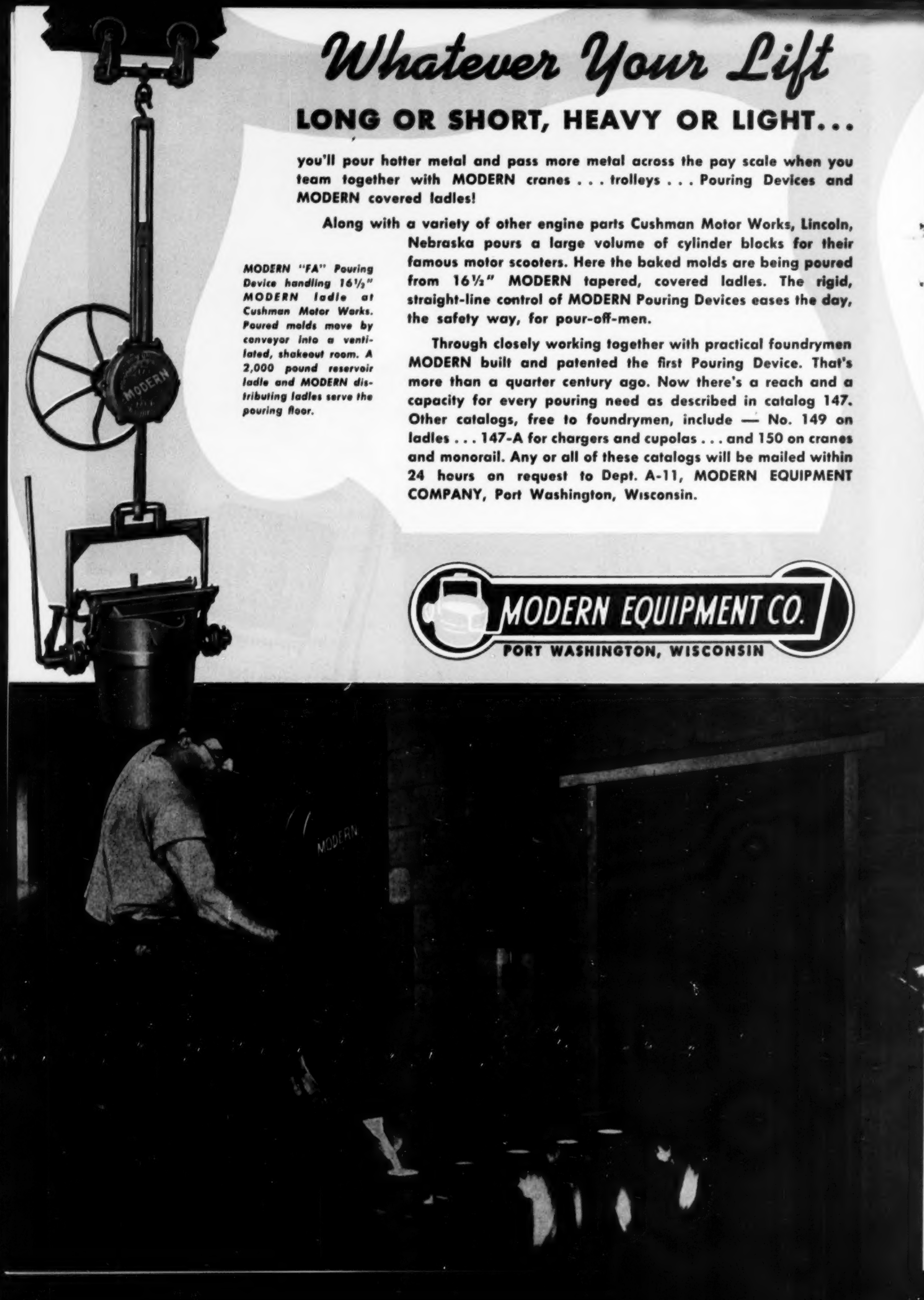
Lectromelt Furnaces will boost your performance record and add to the quality of your metal. Write for catalog #9 describing them in detail. Pittsburgh Lectromelt Furnace Corporation, 316 32nd Street, Pittsburgh, Pennsylvania.

Manufactured in . . . CANADA: Lectromelt Furnaces of Canada, Ltd., Toronto 2 . . . ENGLAND: Birlec, Ltd., Birmingham . . . FRANCE: Stein et Roubaix, Paris . . . BELGIUM: S. A. Belge Stein et Roubaix, Bressoux-Liege . . . SPAIN: General Electrica Espanola, Bilbao . . . ITALY: Forni Stein, Genoa. JAPAN: Daido Steel Co., Ltd., Nagoya

*REG. T. M. U. S. PAT. OFF.

MOORE RAPID

WHEN YOU MELT... *Lectromelt*

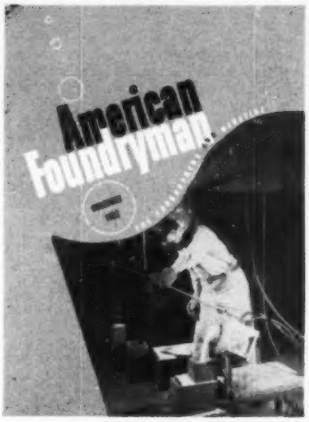


Whatever Your Lift
LONG OR SHORT, HEAVY OR LIGHT...
you'll pour hotter metal and pass more metal across the pay scale when you team together with MODERN cranes . . . trolleys . . . Pouring Devices and MODERN covered ladles!
Along with a variety of other engine parts Cushman Motor Works, Lincoln, Nebraska pours a large volume of cylinder blocks for their famous motor scooters. Here the baked molds are being poured from 16½" MODERN tapered, covered ladles. The rigid, straight-line control of MODERN Pouring Devices eases the day, the safety way, for pour-off-men.
Through closely working together with practical foundrymen MODERN built and patented the first Pouring Device. That's more than a quarter century ago. Now there's a reach and a capacity for every pouring need as described in catalog 147. Other catalogs, free to foundrymen, include — No. 149 on ladles . . . 147-A for chargers and cupolas . . . and 150 on cranes and monorail. Any or all of these catalogs will be mailed within 24 hours on request to Dept. A-11, MODERN EQUIPMENT COMPANY, Port Washington, Wisconsin.
MODERN "FA" Pouring Device handling 16½" MODERN ladle at Cushman Motor Works. Poured molds move by conveyor into a ventilated, shakeout room. A 2,000 pound reservoir ladle and MODERN distributing ladles serve the pouring floor.
MODERN
MODERN
MODERN EQUIPMENT CO.
PORT WASHINGTON, WISCONSIN

American Foundryman

Volume 24 **November 1953** *Number 5*

Published by American Foundrymen's Society



Pouring an experimental heat from a small induction furnace in the laboratories of Allis-Chalmers Mfg. Co., Milwaukee, to develop data for the article on carbon in ferrous alloys, pp. 52-57.

In This Issue . . . .

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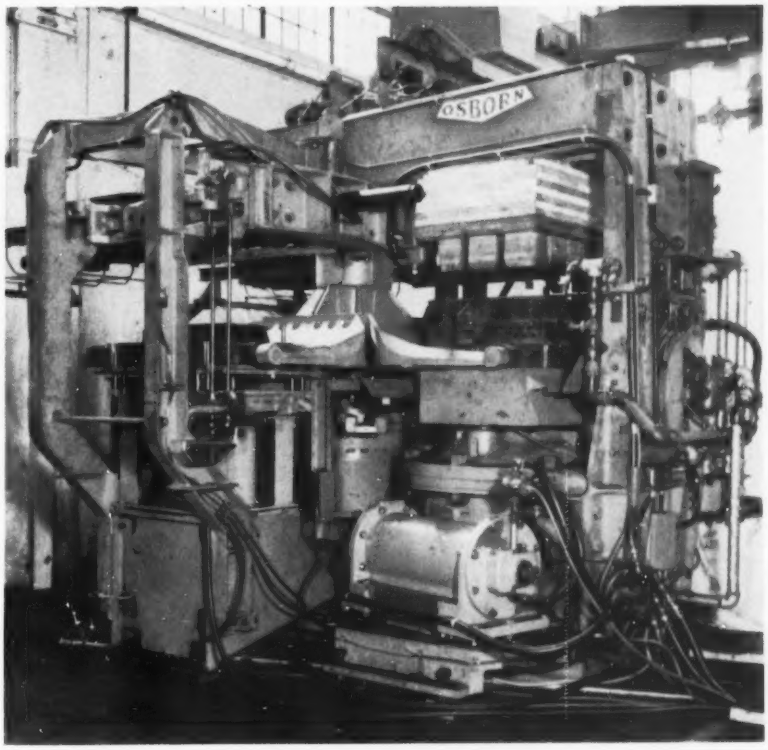
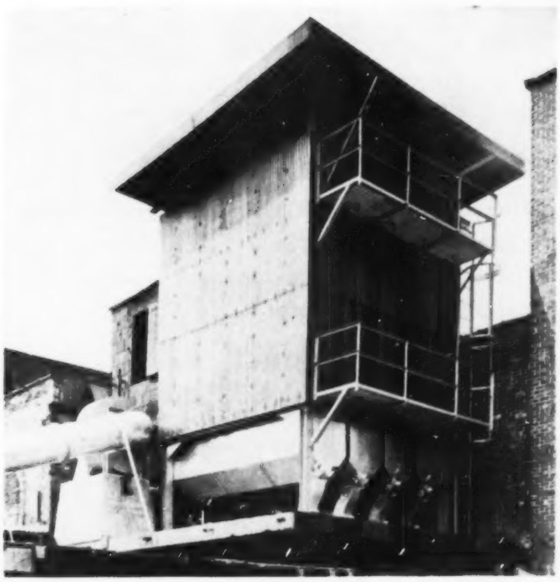
Here's How...

. . . one of the nation's leading automotive foundries is planning to meet the need for improved mold production, involving sand molds and various types of castings. This rotary automatic molding machine, developed by Osborn Mfg. Co., Cleveland, during the past two years, and now under test, weighs 80,000 lb and is said to produce cylinder block half molds at the rate of 240 per hour, and shallower molds at rates up to 300 halves per hour.

For more data, circle No. 1, p. 17





. . . Chicago Steel Foundry Co., Chicago, located baghouse of Whiting dust and fume suppressor outside the foundry building. Fibre glass bags are used to "vacuum clean" impurities from furnace air.

For more data, circle No. 2, p. 17

. . . Ford Motor Co. is using Cable-Link conveyor systems in foundry operations. Conservation of space, reduced tank investment, and elimination of core wash are among the benefits reported.

For more data, circle No. 3, p. 17

VOLCLAY BENTONITE

NEWS LETTER No. 34

REPORTING NEWS AND DEVELOPMENTS IN THE FOUNDRY USE OF BENTONITE

Shifts

DEFINITION—Shifts are sometimes referred to as "cross-joints" or "mismatches". Shifts may occur as a mold shift or as a core shift. A mold shift results in a casting which does not match at the parting lines. A core shift results from variations in dimensions of a cored section when there has been a change in position of the core or misalignment of cores when they are assembled.

PRINCIPLE CAUSE—Poor equipment and careless personnel.

CORRECTION—(1) If the pins or bushings are worn, bent, or misfit, they should be replaced. If the flask equipment is weak or warped it should not be used. (2) The flask should be checked to see whether or not a twisting action occurs when it is assembled. (3) Where bands or jackets are used, care must be taken to see that they are not tight, too worn, bent, or broken.

(4) Pattern equipment should be checked to see if the cope and drag patterns align properly.

(5) Loose or worn dowel pins should be replaced and it is best to use locators where cores are set loosely.

(6) Excess rapping of loose patterns is a common cause of shifts. (7) The setting of improper chaplets is a common cause.

(8) The personnel should be checked carefully to assure that flasks are handled correctly and that slip jackets are not forced onto the assembled cope and drag. (9) Care should be taken when setting weights. (10) Handling of weighted molds on a conveyor should be checked. (11) Rough or improper handling by the molder or weight shifter of the assembled molds should be noted. (12) Improper clamping or uneven clamping produces shifts. (13) Misalignment of cores in assembly may be the cause. (14) Any vibration to cause the cope to move from the drag causes shifts. (15) Molds that explode when poured may cause the near mold to produce a shift.

(16) The personnel at the pouring station should avoid bumping the mold with the pouring ladle, moving the mold from on the conveyor, bumping molds just prior to pouring, and mishandling slip jackets at this station.

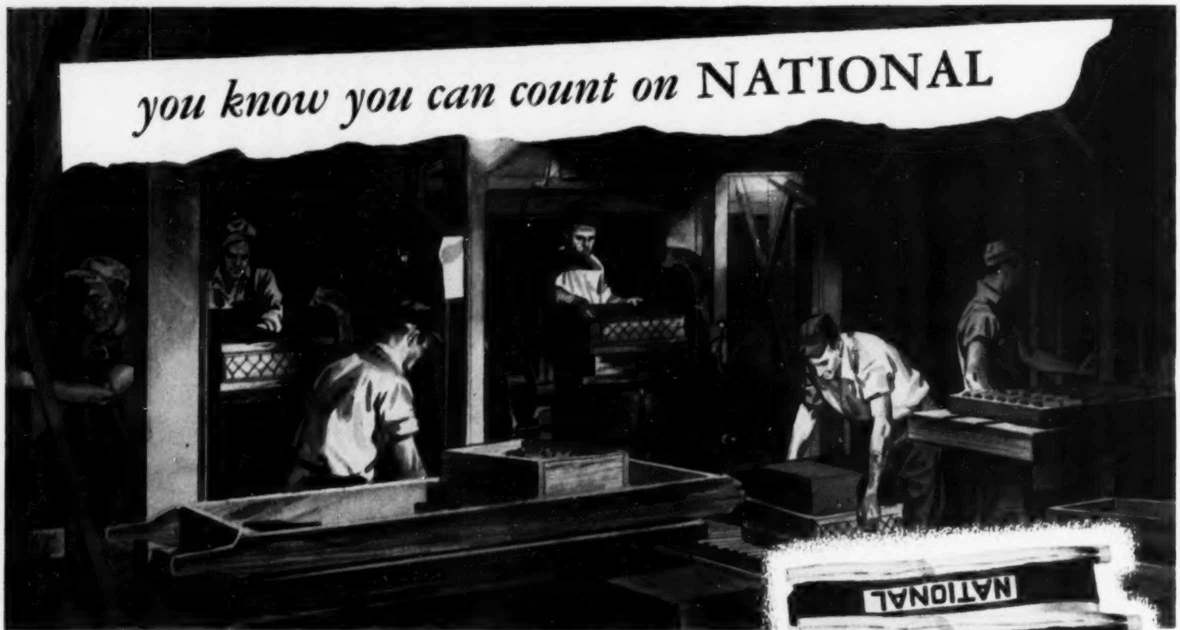
Poor equipment and personnel are the CHIEF causes of this defect, but companies employing good control and supervision generally are not plagued by this foundry defect.

When good control and supervision are present they are usually associated with good sand practice. A wide spread fine silica molding sand, 5% bentonite **(VOLCLAY or PANTHER CREEK)**, *either 5% seacoal or 1% Lyquaflour by weight and no more than 3% moisture content for temper.*

AMERICAN COLLOID COMPANY

CHICAGO 54, ILLINOIS

Producers of Volclay and Panther Creek Bentonite



NATIONAL BENTONITE

MEANS BETTER BONDED MOLDS AND FINER FINISHED CASTINGS

Many experienced foundrymen, like those pictured above, have depended on National Bentonite for better bonding of their molds. They know they can count on National's consistently uniform high quality, good green strength, high hot strength and many other characteristics which contribute to better bonded molds. For years they've found this means better production, with better castings requiring less time in the cleaning room.
You, too, can be sure of better bonds with NATIONAL BENTONITE.

FIRST CHOICE WITH MANY GOOD FOUNDRYMEN FOR YEARS

Baroid

Quick Service From Better Foundry Suppliers Everywhere

Baroid Sales Division ☆ National Lead Company

Bentonite Sales Office: Railway Exchange Building, Chicago 4, Illinois

4483

Letters to the Editor

All letters of broad interest which do not violate AFS policy or good taste are publishable. Write to Editor, American Foundryman, 616 S. Michigan Ave., Chicago 5, Ill. Letters must be signed but will be published anonymously on request.

Community Problems

Thank you so much for your kindness in sending me two complimentary sets of tear sheets of the article *"Industry and the Community: A Reciprocal Relationship."* It is characteristic of the interesting and informative material to be found in American Foundryman.

Rushton W. Skakel, *V.P. & Gen. Mgr.*
Missouri Coke & Chemical Div.
Great Lakes Carbon Corp.
St. Louis

Safety Program

We would appreciate 10 copies of pages 58 and 59 of the July issue of American Foundryman. A great deal of interest has been created due to this article in your magazine, and we are being approached by various organizations for a history and pictures of our display which we used during our current safety program.

L. C. Farquhar, *Works Mgr.*
American Steel Foundries
East St. Louis, Ill.

Steel Casting Design

I would appreciate getting five sets of tear sheets of the article *"Steel Casting Design"* which appeared in the August 1953 issue of American Foundryman.

Harry Czyzewski, *President*
Metallurgical Engineers, Inc.
Portland, Ore.

Electric Furnace Roof

There have been so many requests for my paper *"Insulating an Acid Electric Furnace Roof"* which you published in the February 1953 issue of American Foundryman that I'm all out of copies. I'll appreciate some more tear sheets to send to those who wrote for them.

Charles C. Spencer, *Melting Supt.*
Electric Steel Castings Co.
Indianapolis, Ind.

Introduces Green Sand

Harry Oldham is spending his 50th year in the foundry industry by helping French foundrymen increase casting productivity. Excerpts from a recent letter to Clyde A. Sanders, vice-president, American Colloid Co., Chicago, indicate the nature of some of his work.

Most of the sand used here for molding is natural, and the jobbing foundries do all dry sand work. The jobbing molders are real artists. The old molders know what to do to make a good casting but they're not familiar with production methods as we know them. Considerable work is done by sweep molding; I have seen gears 24 feet in diameter made without patterns.

I have done some work in several foundries on green sand using synthetic sand. One shop in particular is doing very well making many jobs in green sand that formerly were made in dry sand. Trouble is the molders have been making dry sand molds for so long they have to learn how to ram and support molds for green sand. There is a definite difference in the ramming. I am sure they will come along and increase their production as well as the weight of casting made without drying the mold. Your book on foundry sands has been very helpful to me.

I have thoroughly enjoyed my stay in France. Have travelled quite extensively but always come back to Paris for the weekend. I get along well with the people and have made many friends. Sometimes there are language difficulties but there is always a humorous side to this.

I was in England recently for 10 days and spent a day in the foundry where I served my apprenticeship.

Harry Oldham

Sponsors Safety Contest

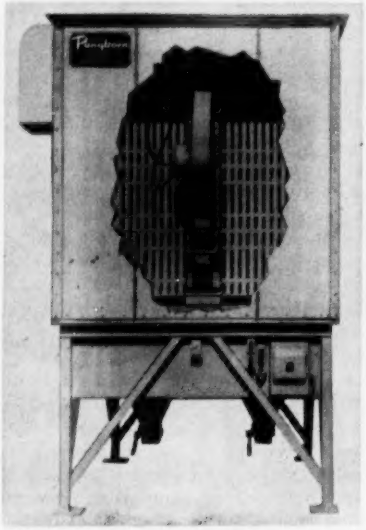
A contest open to employees of member companies has been announced by Malleable Founders Society. Four cash prizes, totalling $250 will be given for the best letters of 1000 words or less on a selected phase of safety in the foundry industry.

The contest closes November 30 and winners will be introduced at the Society's semi-annual Meeting in Cleveland next January.

Products & Processes

For additional information,
use postcard at bottom of page 17

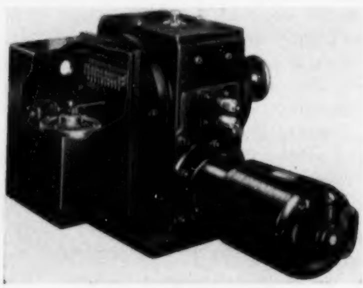
continued on page 12



Dust Collector

This type CH-3 self-cleaning cloth screen dust collector lowers operating and maintenance costs, says manufacturer, by permitting continuous automatic dust collection, constant air volume and suction, and positive reverse flow filter cleaning. *Pangborn Corp.*

For more data, circle No. 4, p. 17



Air-Weight Control

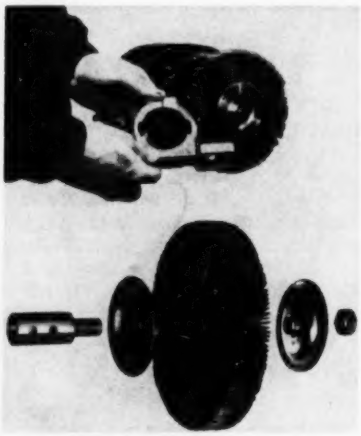
This new unit automatically controls air-weight delivery from motor-driven cupola blowers. Called the Dyna-Jet, the control is equipped with special power-responsive signal system. Operates on principle that air-weight delivered by motor-driven blower is directly proportional to power consumed by driving motor. *Askania Reg. Co.*

For more data, circle No. 5, p. 17

Improved Precipitator

Design 4, type N Roto-Clone dust collector is an improved hydro-static precipitator that separates dust from air by means of S-shaped water curtain, which is claimed to be highly effective in collecting most types of process dust. *American Air Filter Co.*

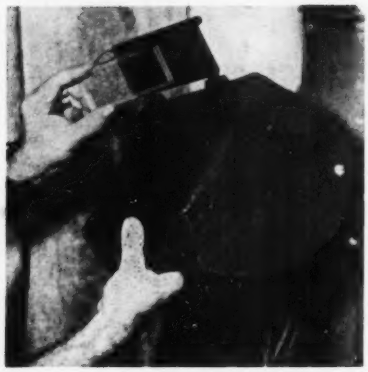
For more data, circle No. 6, p. 17



Flexible Grinding Wheel

Grind-O-Flex is flexible grinding wheel which consists of hundreds of individual abrasive cloth leaves sealed to a hard core. Designed to smooth surfaces, remove flaws without danger of digging into the stock. Available in variety of grits. *Merit Prods. Inc.*

For more data, circle No. 7, p. 17



Welders Magnifying Lens

Ortho-Weld magnifying lens shown above being inserted in lens holder, is a new device to improve vision of welders who wear bifocal glasses. Precision lucite lenses will fit all standard welding helmets. *Bausch & Lomb Optical Co.*

For more data, circle No. 8, p. 17

Heat Directing Panels

Heat directing side panels for use with model PW-189 heat machines permit use of oil-burning machine in great number of applications where concentration of 189,000 btu's in one direction is required, company states. Made of heavy sheet steel, panels cover heat outlet openings of portable heater, can be used singly or in pairs to direct heat as desired. *Fageol Heat Machine Co.*

For more data, circle No. 9, p. 17

For cleaner castings, improved sand recovery get a LINK-BELT foundry shakeout

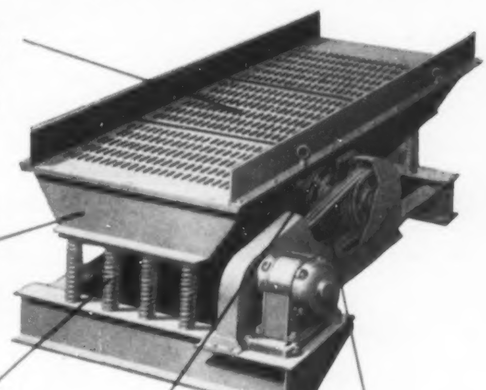
Dust control is facilitated when you centralize operations on an efficient Link-Belt foundry shakeout.

Increased output, improved working conditions also result when you eliminate manual shakeout

EFFICIENT design of Link-Belt foundry shakeouts permits continuous, straight-line operation for greater output. With operating parts recessed, there is ready access from all four sides.

High-speed, economical separation of castings from flasks and molds is achieved, together with faster reduction of sand lumps and temperatures. What's more, costly flask damage is eliminated . . . reclaiming of rods, gaggers and sprues simplified.

Both medium (shown at right) and heavy duty types have rugged construction plus full protection of all moving parts for minimum maintenance. Oversize, cartridge-mounted roller bearings assure accurate alignment. For complete information, ask your Link-Belt sales office for new Book 2438.



LINK-BELT

CONVEYORS AND PREPARATION MACHINERY

LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Colmar, Pa., Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle, Toronto, Springs (South Africa), Sydney (Australia). Sales Offices in Principal Cities.

13.284

Products & Processes

For additional information, use postcard at bottom of page 17

(continued on page 17)

Goggle Cleaner

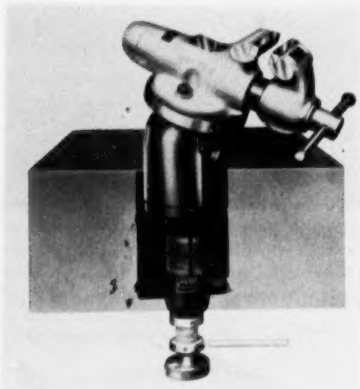
"See" is a new cloth for cleaning safety goggles in industrial plants. One application is said to last for entire day. *Habit Safe Enterprises.*

For more data, circle No. 10, p. 17

Industrial Fluoroscope

This fluoroscope, the Scopemaster, is designed for mass inspection of light alloy castings made by sand, permanent mold, die, or other techniques. Single external control permits moving of parts in any direction while in x-ray beam, facilitating inspection of fillets and corners. *General Electric Co.*

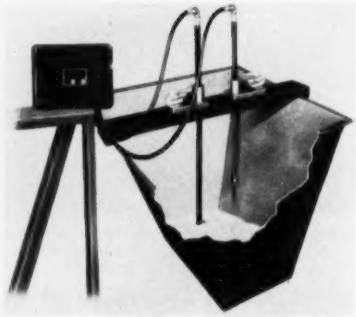
For more data, circle No. 11, p. 17



Heavy-duty Vise

Here is a hydraulic PowRarm with carrying capacity of 1000 lb. Useful in foundries for positioning castings. *Wilton Tool Mfg. Co.*

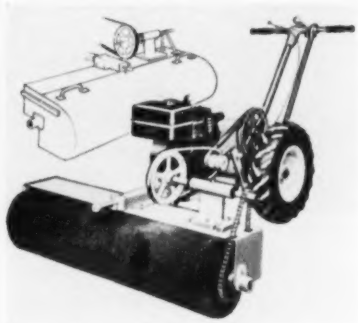
For more data, circle No. 12, p. 17



Automatic Sand Distribution

The Hoppertrol unit controls air-operated plows for automatic distribution of sand to several hoppers or bins. *Harry W. Dietert Co.*

For more data, circle No. 13, p. 17



Motorized Sweeper

This completely motorized power sweeper does effective job on large pavement and floor areas, will pick up metal shavings. *C. L. Eshelman Co.*

For more data, circle No. 14, p. 17

Open-air Storage

This newly developed metal storage building is intended for use in protecting equipment and foundry sand where they must be left in the open. It is sectional and mounts on a track rather than a foundation. Sections tilt from either side for easy access, or slide apart to provide unlimited head room for handling, or telescope completely. *Yard-Stor Shelter Co.*

For more data, circle No. 15, p. 17


CLECO
AIR TOOLS FOR FOUNDRIES
Foundries everywhere get high production and low maintenance costs when they standardize on Cleco rammers, grinders and chippers. Write us for full information or ask your Cleco representative.
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CLECO RAMMERS
CLECO CHIPPERS AND SCALERS
CLECO BLOW GUNS
CLECO AIR TOOLS
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In Canada: Cleco Pneumatic Tool Company of Canada, Ltd., 927 Millwood Road, Toronto (Leaside), Ontario
4573

Talk of the Industry

NEW BLENDED COKE that gives higher metal to coke ratios (14 to 1) and allows higher melting rates is rumored to be in use in several shops. More costly, the coke is dense and strong and stands up well in large stacks – also withstands abusive handling. Some report savings in cost of metal at spout despite coke cost because of savings in metallic charge composition made possible with this coke. Lower sulphurs and improved physical properties are also reported. Refractory life seems to be improved and iron fluidity is supposed to be superior.

PATTERN WOOD from Peru is gaining popularity after undergoing almost five years of tests. Users report the wood is lighter than white pine . . . it cuts, carves, and sands well with grain and on end grain . . . is dimensionally stable under foundry conditions . . . holds shape unusually well even in thin sections.

HIGH HOT STRENGTH SHELLS for C-process molds can be produced by adding a few per cent of western bentonite, it is reported. Meager information available indicates the addition is especially useful in cast of high pouring temperature alloys.

CHILL TESTING has been tentatively standardized by American Society for Testing Materials, along with preparation of copper and copper-base alloys for electroplating and 61 other specifications and recommended practices. Designation of the chill test tentative standard is A367-53T. It describes a wedge test and a chill test and is designed to "apply to gray irons which are to be free of chill in the casting and to chilled irons which are to have a specified depth of chill in the casting." The plating procedure (B281-53T) is a recommended practice and not intended as a standard but as a guide "to platers in setting up a suitable cleaning and conditioning cycle preparatory to electroplating on copper and copper-base alloys."

NATURAL FLAKE GRAPHITE FOR CRUCIBLES, a strategic mineral, is being purchased for the National Stockpile. National Bureau of Standards has completed a study indicating that certain domestic graphites are fully as good as traditional imported material. Results show that refractoriness of graphite ash (ranges from PCE 5 to 28 depending on source) is no criterion for judging graphite quality. Surface area of graphites "as received" ranges from 0.34 to 26.50 square meters per gram. Lower figures in range of 2 to 4 are reported for graphites from Alabama, Pennsylvania, and Madagascar, all of which produce high quality crucibles.

TELLURIUM ELIMINATES PINHOLES in nodular iron castings according to a foundryman who has been adding one gram of tellurium (comes in pellets about the size of an aspirin tablet) per 100 pounds in the ladle. The additien is dropped in after the nodulizing alloy is added, when the ladle is about half full. Finally the graphitizing addition is added. No extra ferrosilicon is reported to be needed to overcome the carbide stabilizing effect of the tellurium and there are evidently no harmful effects on mechanical properties.

ABRASIVE FRIABILITY (opposite of toughness) controls rate of grit breakdown and presentation of new cutting faces to casting being ground. Breakdown and release of dulled grits prevents glazing. Increased recognition of role of friability has influenced trend toward broader use of mixed grits (silicon carbide and alumina) for snagging cast iron.

USE-

MONORAIL
for
Modern Foundry Handling

It meets all requirements for space limitation. Uses overhead space under congested areas.

Versatile application. Hand or power operated carriers . . . many automatic features available.

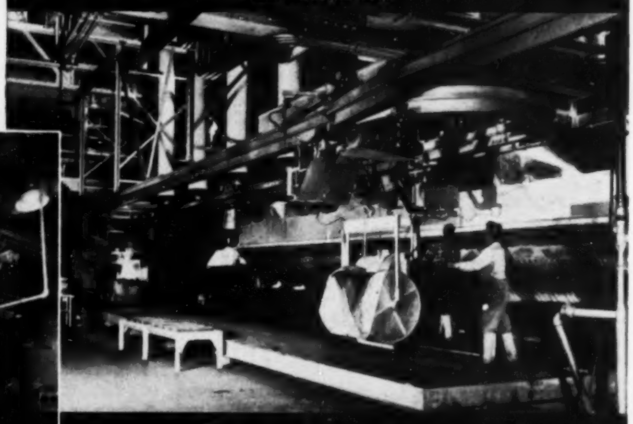
MonoRail is permanent, inexpensive and has extremely low maintenance costs.

SEND FOR BULLETIN C-1

or we'll be glad to have our representative call on you.

Free moving cranes cover large pouring floor

Hand pushed cranes serve mold preparation from conveyor loop



Continuous pouring with MonoTractor Carriers

Automatic dispatch delivery of fresh core sand

MonoTractor carrier serves shakeout from MonoRail loop

AMERICAN MONORAIL COMPANY

OVERHEAD HANDLING EQUIPMENT

13122 ATHENS AVENUE • CLEVELAND 7, OHIO

Products & Processes

Fill out postcard below for complete information on products listed in these pages.

Continued from page 12

CONVENIENT FORM FOR ORDERING INFORMATION

Chip-Retriever

Manufacturer is offering a new GS magnet said to offer lifetime permanence through a single pole magnetic process. Removes chips from blind drill and top holes on production lines. Unit is no larger than a fountain pen, is mounted in fibre nonconductive case with pocket clip. Complete information available. *General Scientific Eqpt. Co.*

For more data, circle No. 16 on card

Burn-Proof Enamel

This new water-reducible industrial enamel "refuses to burn" at normal operating temperatures. Designed for application on metals, finish is an emulsion type enamel in which water is employed both as an ingredient and a reducing agent. Manufacturer claims it is first successful adaptation of water emulsion process in field of industrial coatings. Material is said to be impossible to ignite in liquid state at normal room or operating temperatures. Limited combustion is possible after application and drying. *Sherwin-Williams Co.*

For more data, circle No. 17 on card

Battery-Operated Truck

The WorkLifter, new materials handling equipment, lifts loads of 750-1000 lb to height of five feet. Battery-operated, it may be used anywhere. Two heavy-duty batteries in series provide sufficient power for day-long, continuous duty, or several days of intermittent use. Batteries are recharged by plugging into any 110-volt ac electric outlet. Circuit breaker prevents damage by over-charging, allowing overnight recharging. WorkLifter has maximum safe capacity of 1100 lb, operates from 5-¼ in. above floor to 5 feet. Rubber swivel casters and solid rubber wheels are equipped with roller bearings. *Economy Engr. Co.*

For more data, circle No. 18 on card

Hand Pyrometer

The recently announced FH-1 hand pyrometer combines a number of functions in a single unit, with a variety of tips and a great number of applications. Measures temperature of any surface, liquid, gas, or molten metal, from 0 to 1500 F. Said to give consistent accuracy and long service life. *Gen. Electric Co.*

For more data, circle No. 19 on card

Industrial Scales

New industrial line of well-known manufacturer includes full range of models, from bench scales to heavy duty motor truck scales. Line features one-piece sectors in new, full floating, double pendulum mechanism. This construction is claimed to increase precision and strength, and to eliminate hand adjustments heretofore necessary. Indicating heads can be installed to face in one of eight different directions, or to swivel fully through 360 degrees. *Toledo Scale Co.*

For more data, circle No. 20 on card

Pallet Dolly

Roll Rite universal pallet dolly rolls and steers over any type floor without swivel casters, it is claimed. Maneuverability, ease of operation and proven ability to roll on rough or slatted floors are the advantages of the improved Roll Rite dolly. *Roll Rite Corp.*

For more data, circle No. 21 on card

Reader Service Dept.

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CITY AND ZONE

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First Class Permit No. 14480, Sec. 34.9 P. L. & R., CHICAGO, ILL.

Reader Service

AMERICAN FOUNDRYMAN

616 S. Michigan Avenue

Chicago 5, Illinois

Free Foundry Information

For additional information use postcard at bottom of this page

Sand Mex

A new engineering folder describing Sand Mex, a specially prepared graphite product for use with foundry sand, is now available. The bulletin states that for just a few cents per ton of sand, Sand Mex improves the flowability and increases the heat resistance of foundry sand. Reduced wear and abrasion on all sand handling equipment and more accurate pattern reproduction, producing better molds in less time, is also claimed. Sand Mex can be used in a heap or system with naturally bonded or synthetic sands for both ferrous and non-ferrous castings, the folder points out. *United States Graphite Company, Division of the Wickers Corp.*

For more data, circle No. 22 on card

Materials Handling Techniques

Recent techniques of layout and conveyor-handling of foundry materials are described in a reprint now available. The pamphlet pictures and describes several major improvements, based on these techniques, that have minimized manual handling and help modernize a Connecticut foundry. It briefly describes the old layout, its short-comings, and shows the benefits derived from the modernization move. The description takes you step-by-step through the entire foundry operation. It shows how a molder prepares a mold for pouring without leaving his molding station, how the roller-conveyor system for handling flasks works, and how the panel board for controlling the handling system operates. Also described are the automatic handling of sand after shakeout. A two-view schematic drawing shows and over-all view of the conveyor system, and seven photos show the system at various stages of operation. *Gifford-Wood Co.*

For more data, circle No. 23 on card

Centriblast

Catalog describes the "Centriblast" airless rotary barrel blast machine and provides the answer to fettling problems in both large and small foundries, engineering works and forges. Well illustrated brochure showing the various models and parts is now available. *Stamford Engineering Works.*

For more data, circle No. 24 on card

Tool Catalog

Mail order catalog now available showing necessities for tool shops, factories, garages, etc. Shows all types of grinding wheels, mounted stones, standing discs, circular saws, rotary cutters and many other items. *Schupack Supply Co.*

For more data, circle No. 25 on card

Furnace Manual

This manual is devoted primarily to the installation and care of furnaces and published with the idea of suggesting ways and means to the foundrymen of getting the longest life and peak performance from their furnaces. Book is an instruction and service manual for non-ferrous melting furnaces and is now available. *The Stroman Furnace & Engineering Co.*

For more data, circle No. 26 on card

Cupola Emission Problem

An 18-page booklet, well illustrated, dealing with the cupola emission problem and its solution is now available. The text of the booklet was presented to the semi-annual meeting, East Central Section, Air Pollution Control Association in Harrisburg, Pa. *Grindle Corp.*

For more data, circle No. 27 on card

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CITY AND ZONE

NICKEL ALLOY IRONS

develop improved properties

plus all the basic advantages of plain cast iron

PLAIN GRAY IRON is, structurally, a steel matrix containing graphite flakes. Engineering, physical, processing and service properties are wholly dependent upon the character and disposition of these flakes, and upon the nature of the matrix.

The matrix of nickel alloyed irons closely resembles the pearlitic matrix found in high carbon steels, whereas the matrix of ordinary plain iron resembles that found in low carbon steels. Compositions of nickel alloy irons can be adjusted to reduce "chill" in thin sections without risk of forming "spongy" regions in heavy sections. This promotes uniform strength, improved machinability, pressure tightness and wear resistance.

Hardness in nickel cast irons results from improvement of the matrix. Chilled areas and hard carbides, which impair machinability, are obviated. Nickel improves response to heat treating. In fact, use of nickel alone or with other alloying elements plays an important part in meeting a variety of requirements.

Accordingly ... nickel alloyed irons permit production of castings with high levels of the following properties:

Strength

Tensile and transverse strengths of castings are greatly increased by the addition of nickel to cast irons of properly adjusted base mixture. The ratio of compressive strength to tensile strength is retained. Greater uniformity of strength in thick and thin sections is achieved.

Elasticity

The elastic modulus increases with strength. In this respect nickel-containing irons of the high strength type possess good stiffness and do not deform permanently under loads that would be damaging to irons of lower elastic modulus.

Damping Capacity

The damping capacity inherent in gray cast iron is not impaired by the presence of nickel.

Wear Resistance

The uniformly pearlitic matrix of nickel cast irons appreciably improves wear resistance. The uniformly fine graphite flake distribution, achieved in suitably processed irons *without formation of a poor wearing dendritic condition*, affords optimum resistance to wear and galling.

Pressure Tightness

Characterized by dense grain structure and fine dispersion of graphite throughout, nickel alloy irons are close-grained and offer an extraordinary degree of pressure tightness under high hydrostatic pressures, without sacrificing machinability.

Applications

Heavy machinery frames and *beds* are typical of cast parts that benefit from the rigidity and good damping capacity of nickel cast irons. *Cylinder* and *pump liners, gears, dies, machine tool ways, saddles* and *tables* exemplify parts produced in nickel irons to assure greatly increased strength and wear resistance. And nickel alloyed iron is used for *heavy duty brake drums* to resist heat checking, thermal shock, wear and galling. The nickel cast irons are readily heat treated, and respond particularly well to flame and induction hardening.

At the present time, the bulk of the nickel produced is being diverted to defense. Through application to the appropriate authorities, nickel is obtainable for the production of engineering nickel cast irons for many end uses in defense and defense supporting industries.

AF 11-53

The International Nickel Company, Inc.
Dept. AF, 67 Wall St., New York 5, N. Y.

Please send me booklet entitled, "Guide to the Selection of Engineering Cast Irons."

Name ______________________ *Title* ______________

Company ______________________________________

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EMBLEM OF INCO SERVICE

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N. Y.

H. G. Haines . . . with Woodruff

R. F. Dalton . . appointed superintendent

H. C. Sterling . . general superintendent

Foundrymen in the News

Harold G. Haines has been metallurgist with Woodruff & Edwards, Elgin, Ill., since early August. He was formerly metallurgist at the Semi-Steel Div., Howard Foundry Co., Chicago.

Robert F. Dalton has been appointed superintendent of Electronicast, Inc., Chicago. He was formerly development engineer, Industrial Gypsum, Lime & Paper Div., United States Gypsum Co., Chicago.

George D. Gilbert, secretary and director of Chain Belt Co., Milwaukee, has resigned as an officer and division manager and a director. His decision was made to allow him to devote more time to his personal affairs. **William C. Messinger,** assistant to the manager of the construction Machinery Div., has been elected secretary to fill the vacancy left by the retirement of Mr. Gilbert. **Edward M. Rhodes** has been promoted to division manager, Baldwin-Duckworth Div., to succeed Mr. Gilbert in that capacity. **Roland V. Poisson** has been appointed sales manager, Baldwin-Duckworth Div., replacing Mr. Rhodes. **A. R. Abelt,** formerly vice-president in charge of field forces for Chain Belt, is appointed vice-president-sales. **George W. Woodland** is appointed to the newly created position of manager of field forces for the company's industrial divisions. **Gilbert J. Schuelke** is now sales manager of the Chain and Transmission Div. **R. V. Krikorian** is appointed manager of the Chain Belt Ordinance Div.

The board of directors of Dominion Brake Shoe Co., a subsidiary of American Brake Shoe Co., New York, have elected **Thomas E. Akers** as chairman. Formerly president of the Canadian Co., he succeeds Maurice N. Trainer, who continues as president of the parent company. **Kenneth T. Fawcett** was elected president. He was formerly vice-president of Dominion Brake Shoe. **Maynard B. Terry** was elected vice-president. He is also president of the American Brakeblok Div. of the Company.

P. C. Haldeman, general superintendent of the Rolls Div. Blaw-Knox Co., has been promoted to works manager of the Foote Construction Equipment Div. **H. C. Stirling** will succeed Mr. Haldeman as general superintendent in charge of castings at the Lewis Machinery Div. of the company. The Rolls Div. is located in Pittsburgh, Pa., and the Foote Div., is located in Nunda, N. Y.

David Walters has been appointed chief industrial engineer of Bohn Aluminum and Brass Corp., Detroit. He will serve on the staff of the operations manager, G. A. Schwenk. Prior to joining Bohn he was associated with the Detroit Aluminum and Brass Corp.

Five promotions have been announced by Eaton Manufacturing Company's Foundry Div., Vassar, Mich. **S. David Tyler,** formerly factory manager, has been appointed to assistant general manager. Assistant to the resident manager, **Paul W. Olson,** has been promoted to resident manager. **Howard R. Johnson** has been appointed to factory

continued on page 26

W. C. Messinger . . . elected secretary

G. D. Gilbert . . . resigns

David Walters . . . Bohn appointment

H. R. Johnson . . . Factory Manager

P. W. Olson . . . resident manager

S. D. Tyler . . . Eaton promotion

Foundrymen in the News

continued from page 25

manager. Prior to his promotion he was assistant to the factory manager and prior to joining Eaton he was associated with the Keeler Brass Co., John Wood Manufacturing Co., and Dow Chemical Co., in various engineering capacities. **Ralph F. Evert,** formerly production manager, has been promoted to assistant sales manager. Prior to joining Eaton, Mr. Evert held engineering positions at Baker Perkins Co., Columbia Mills, and General Motors Steering Gear Div., all of Saginaw, Mich. **Daniel J. Schindehette** has been appointed plant comptroller. He was formerly assistant plant controller and prior to joining Eaton was with the Saginaw Steering Gear Div. of General Motors Corp.

Eugene J. Lenar, formerly with Western Michigan Steel Foundry, Muskegon, Mich., has joined the Carboloy Dept. of General Electric Co. at the Edmore, Mich., plant. He is joining the company as an engineer in the metallurgical process and quality control unit for permanent magnet materials. **Charles E. St. Thomas** has been named manager-advertising and sales promotion at the Carboloy Dept. Mr. St. Thomas had been news bureau manager since August 1952 when he joined Carboloy after release from active duty with the Air Force. Prior to that time he was with the general news bureau of the General Electric Co. in Schenectady, N. Y. **Roy C. Nichols,** formerly with Diesel Equipment Div. of General Motors, Grand Rapids, Mich., has joined the Carboloy Dept. as an engineer.

Hugh J. Richardson has been appointed works manager of Brabant Brass Manufacturing Co. He will assume responsibility for all manufacturing operations. Prior to joining the Brabant organization, Mr. Richardson was factory manager of the Penberthy Injector Co. and previous to that was associated with the Industrial Engineering Div. of Continental Motors.

Paul B. Brown has been appointed to the office of vice-president and general manager of the Peninsular Grinding Wheel Co., Detroit. Until recently he was vice-president of the Bonded Products and Abrasive Grain Div. of the Carborundum Co.

George John has been appointed metallurgist at Textile Machine Works, Foundry Div., Reading, Pa. Previous to this appointment he served as assistant to the late Werner Finster, chief metallurgist.

F. R. Schulz has been appointed field engineer in the Detroit area for Lamson Corp., Syracuse, N. Y. He will handle the sale of all Lamson's products and will have his headquarters in Detroit.

William A. Geisler has joined the staff of Lester B. Knight & Associates, Chicago. Mr. Geisler has had 26 years foundry operating, research and development experience in the United States and Germany, including assistance on the "Fiat Final Report No. 1168," which started shell molding in the United States.

F. R. Schulz . . . field engineer

George John . . . metallurgist

P. B. Brown . . . vice-president

Advertisement

ELECTROMET Data Sheet

A Digest of the Production, Properties, and Uses of Steels and Other Metals

Published by Electro Metallurgical Company, a Division of Union Carbide and Carbon Corporation, 30 East 42nd Street, New York 17, N. Y. • In Canada: Electro Metallurgical Company of Canada, Limited, Welland, Ontario

How Ladle Inoculants Reduce Chill . . . Produce High-Strength, Machinable Iron

One of the most significant developments in the field of cast iron metallurgy during recent years has been the widespread growth of the process of "inoculation" in producing quality metal to strict specifications. Inoculation has been defined as "a process in which an addition is made to molten cast iron for the purpose of altering or modifying the micro-structure of the iron and thereby improving the mechanical and physical properties to a degree not explainable on the basis of the change in composition."*

Various ladle addition alloys are used for inoculation of cast iron, but there is a wide range in the efficiency and potency of these materials. The 50 per cent and 75 per cent ferrosilicons are mild inoculants, but they are used as ladle additions principally as a means of adjusting the silicon content of cast iron. The 85 per cent and 90 per cent grades of ferrosilicon are much more effective inoculants. Inoculating power is further improved through the use of special inoculating alloys, such as silicon-manganese-zirconium ("SMZ" alloy) and calcium-silicon.

*Definition by H. W. Lownie, Jr.—A.F.S. Symposium on "Inoculation of Gray Cast Iron."

ELECTROMET produces a number of alloys for inoculation, each of which has specific applications. The graphitizing inoculants are:

"SMZ" Alloy	60-65% silicon 5-7% manganese 5-7% zirconium
Calcium-Silicon	30-33% calcium 60-65% silicon
90% Ferrosilicon	92-95% silicon
85% Ferrosilicon	83-88% silicon
Special Graphitizer	A mixture of ferrosilicon and graphite for special uses.
75% Ferrosilicon	73-78% silicon
50% Ferrosilicon	47-51% silicon

These inoculants are usually added to the molten iron as it leaves the cupola spout, or during transfer from one ladle to another.

"SMZ" Alloy—An Efficient Inoculant

The benefits of inoculation are obtained largely as the result of rigid control of the structure of the graphite phase of cast iron which has received this treatment. The results of inoculation on the properties of a typical cast iron are demonstrated by the accompanying illustrations showing the effect of adding various amounts of "SMZ" alloy.

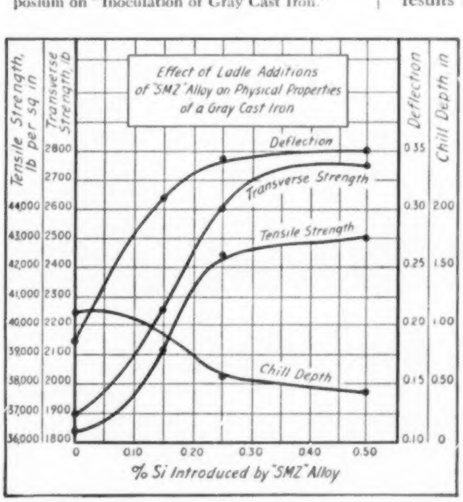


Fig. 1—These curves show how additions of "SMZ" alloy reduce depth of chill and improve mechanical properties when added to a series of irons selected to give the following final analysis: 3.10 total carbon, 0.60 combined carbon, 1.80 silicon, and 0.50 manganese.

Effects of Inoculation

The effects of graphitizing inoculants are: a drastic decrease in the chilling tendency of a given iron, a mild decrease in Brinell hardness, lowering of the section sensitivity of the metal, a definite increase in tensile strength, and an increase in transverse strength and deflection. These benefits are usually accompanied by improved fluidity, better castability, and improved resistance to wear.

Fig. 2—These chill blocks show how progressive additions of "SMZ" alloy reduce the depth of chill.

New Stabilizing Inoculant

For the production of cast iron, ELECTROMET developed recently a special low-carbon foundry ferrochrome. This silicon-chromium alloy is so balanced in composition that it increases the strength and hardness of gray iron, without increasing chill. The new alloy has a nominal analysis of 30 per cent silicon and 50 per cent chromium. It has excellent solubility in iron, and the inoculating effect of the silicon content makes it possible to add up to 1 per cent chromium to gray iron as a ladle addition, with no appreciable increase in chill. Castings treated with the new alloy have an excellent balance between machinability and good resistance to wear.

Booklets Available

Further information about ladle inoculants is given in the booklets, "SMZ Alloy and Its Uses as a Ladle Addition to Cast Iron" and "Silicon-Chromium Alloy in Complicated Iron Castings." You may obtain copies, free of charge, by writing or phoning to the address given above or to the nearest ELECTROMET office: in Birmingham, Chicago, Cleveland, Detroit, Los Angeles, New York, Pittsburgh, or San Francisco. In Canada: Welland, Ontario.

GOOSE LAKE **GROUND FIRE CLAY** (Standard Grind)

Smooth, high quality fire clay with low shrinkage. For laying up fire brick and other clay mixtures. Most widely used ground fire clay for general foundry and steel plant needs.

GOOSE LAKE **FIRE CLAY FLOUR** (Pulverized)

Extra fine preparation of clay for laying up fire brick with tight joints and for foundry molding sand bond mixtures. Has good flowability with wide moisture range and excellent durability.

GOOSE LAKE **GRUNDITE BOND CLAY**

Special bond clay containing "Illite," a newly discovered mineral that improves molding sands used for malleable and gray iron castings. It insures flowability and better cleaning.

GOOSE LAKE **FIRE CLAY BRICK**

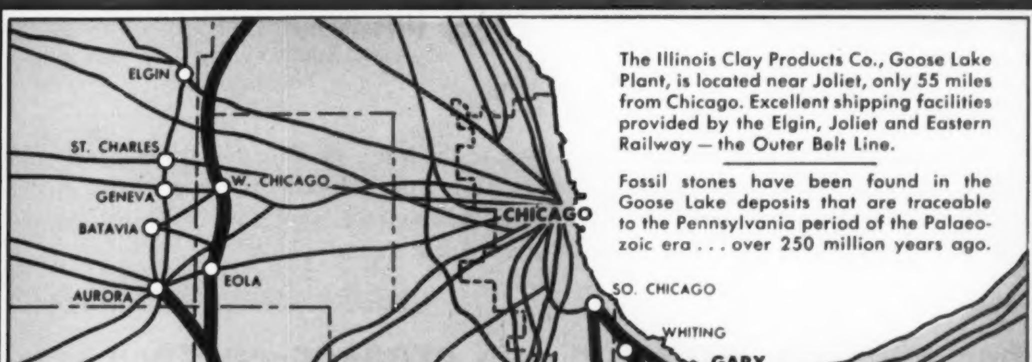
Dense, well-burned plastic fire clay brick for use in iron and steel ladles, cupolas and for general intermediate heat duty requirements. Dry pressed and fired in modern tunnel kilns.

GOOSE LAKE **FIROX**

Cupola and Ladle Patch Mixture for use with air gun or by hand. A new highly refractory product for superior service.

ILLINOIS CLAY PRODUCTS COMPANY

Sales Office	Main Office
Chicago, Illinois	**Joliet, Illinois**
208 S. LaSalle St.	Barber Building



The Illinois Clay Products Co., Goose Lake Plant, is located near Joliet, only 55 miles from Chicago. Excellent shipping facilities provided by the Elgin, Joliet and Eastern Railway — the Outer Belt Line.

Fossil stones have been found in the Goose Lake deposits that are traceable to the Pennsylvania period of the Palaeozoic era . . . over 250 million years ago.

GOOSE LAKE

REFRACTORIES

HOW WHEELABRATOR® STEEL SHOT

Strikes at Cleaning

LESS ABRASIVE CONSUMPTION

General Heat Treating Co., Syracuse, N. Y. is able to clean 217 lbs. of heat treat work for every pound of Wheelabrator Steel Shot consumed, compared to only 34 lbs. of work cleaned per lb. of malleabilized grit formerly used.

INCREASED PARTS LIFE

At a progressive Eastern Steel Foundry the use of Wheelabrator Steel Shot resulted in a 150% increase in blade life with a corresponding increase in the usable life of other machine parts.

LOWER CLEANING COSTS

A large New York gray iron foundry slashed abrasive costs from $2.49 per hour to $1.54 . . . a 38% reduction . . . when they switched from chilled iron grit to Wheelabrator Steel Shot.

LESS MAINTENANCE LABOR

Due to the 300% increase in machine parts life resulting from the use of Wheelabrator Steel Shot, maintenance labor costs were slashed at a prominent Eastern plant.

REDUCES SHIPPING, HANDLING AND STORAGE COSTS

American is the only Blast Equipment Manufacturer Producing Steel Shot

AMERICAN'S STEEL SHOT PLANT

the HEART of Your Cost Reduction Problem

19 CONTROL CHECKS FOR QUALITY ASSURE PEAK PERFORMANCE

It took a new plant and new production methods, unique in the industry, to produce this properly balanced, metallurgically superior steel shot. 19 control checks insure the highest standard of uniformity in structure, hardness, solidity, toughness, size and shape. This meticulous attention to every phase of production is your assurance that Wheelabrator Steel Shot will provide peak performance and economy for your cleaning operations.

Another *American* FIRST

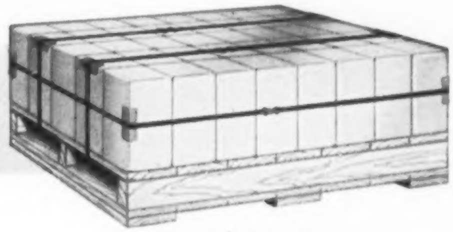
50 LB. CARTONS and PALLETIZING

For Safety - Convenience - and Lower Cost to You

Wheelabrator steel shot is now packaged in strong, easy-to-handle 50 lb. cartons—more rugged and durable than antiquated burlap bags (100 lbs.). Shipments of 1 Ton or more are securely strapped to expendable pallets (40 cartons to a pallet) for safer transportation and easier handling and storage. *All at no extra cost!* Another "plus" for Wheelabrator Steel Shot — the modern blasting abrasive.

Easy-to-carry, easy-to-pour, this new carton reduces strain and fatigue in abrasive handling.

50 lb. carton



A Palletized 1-Ton Shipment

Send for Bulletin No. 89

Bulletin 89 tells the complete story about "Wheelabrator" Steel Shot and what it means to the user in terms of performance and economy. Write for your copy today.

THE AMERICAN MOLDER ®

American

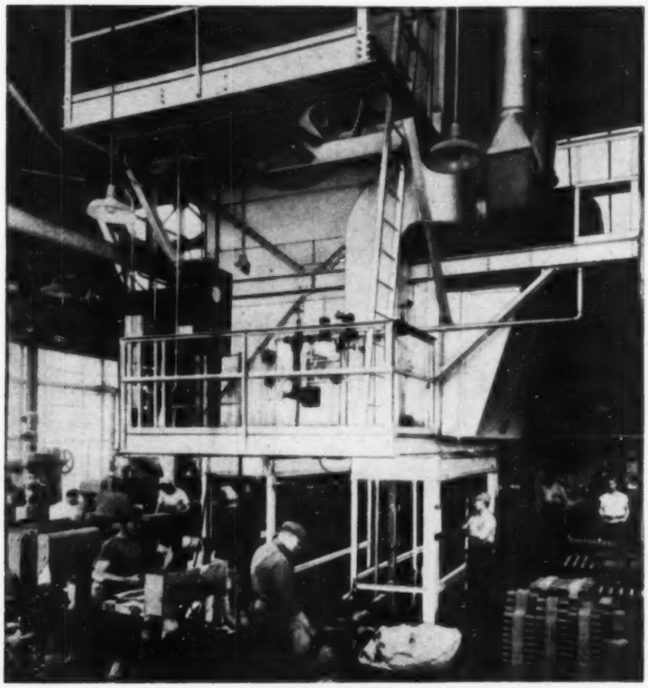
WHEELABRATOR & EQUIPMENT CORP.

630 S. Byrkit St., Mishawaka, Indiana

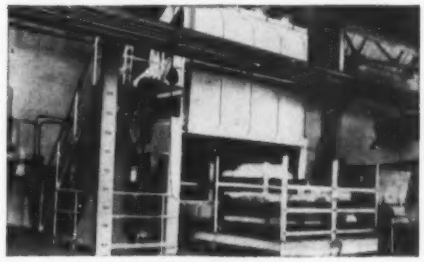
Repeat orders for

COLEMAN OVENS

prove outstanding performance



Coleman Tower Oven at Wells Manufacturing Co.



Coleman Car-Type Core Ovens at Pettibone-Mulliken Co.

Coleman Car-Type Mold Oven at The Bullard Co.

Battery of Coleman Transrack Core Ovens at The Crucible Steel Castings Co.

You should get all the facts concerning the core and mold ovens you expect to install . . . because the right ovens will increase your production and your profits. Over 80% of Coleman Ovens are "repeat orders" from past customers . . . proving performance to *complete satisfaction.* Coleman Ovens are the choice of leading firms in every branch of the foundry industry from small shops to large production foundries. You get over 50 years of know-how and experience in every Coleman Oven, so why gamble with inferior designs? Coleman Ovens of proved performance cost no more . . . and pay for themselves quickly out of savings in fuel, labor and increased production. Get the facts today . . .

WRITE FOR BULLETIN C

A COMPLETE RANGE OF TYPES AND SIZES

for every core baking and mold drying requirement:

- Tower Ovens
- Horizontal Conveyor Ovens
- Car-Type Ovens
- Transrack Ovens
- Rolling Drawer Ovens
- Portable Core Ovens
- Portable Mold Dryers

THE FOUNDRY EQUIPMENT COMPANY

1831 COLUMBUS ROAD CLEVELAND 13, OHIO

world's oldest and largest foundry oven specialists

is setting records for lining life in high-frequency induction furnaces

INDIANA
Using Taylor Zircon grog-type ramming mix, an operator of two, 300-lb. Ajax-Northrup furnaces consistently obtains 100 heats melting nickel-chrome alloy or stainless steel. Magnesia linings averaged 20-25 heats.

SOUTH CAROLINA
Foundry superintendent writes his Taylor Zircon lining cost 0.0005 *cents per pound* after tapping 100th heat—116,650 lbs. total—of cast iron from 1000-lb. Ajax-Northrup furnace. Anticipates getting 200,000 lbs. total melt before relining. Formerly averaged 35-50 heats.

NEW YORK
Steel company obtained 324 heats from Taylor Zircon lining in 700-lb. Ajax-Northrup furnace melting stainless and a wide variety of alloy steels. A new record for this foundry!

These performance reports are being duplicated by many foundries across the nation. Linings of Taylor Zircon Ramming Mix are outperforming linings rammed of magnesia, magnesia-alumina spinel and/or sillimanite or mullite in Ajax-Northrup, Allis-Chalmers and other types of high-frequency induction furnaces melting nickel, stainless steel and similar high nickel-chrome alloys. CAUTION—Taylor Zircon linings are *not* recommended when a large percent of dirty scrap or appreciable amounts of iron oxide are present in the melt.

Write us for recommendations on your melting requirements.

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TAYLOR ZIRCON · TAYLOR SILLIMANITE
REG. U. S. PAT. OFF.

The CHAS. TAYLOR SONS Co.
A SUBSIDIARY OF NATIONAL LEAD COMPANY
REFRACTORIES SINCE 1864 • CINCINNATI • OHIO • U. S. A.

Look for Tomorrow's Craftsmen Today . . .

■ Lack of skilled labor, shortage of labor, getting young people to enter the industry, and training the new man have long been among the major problems of the foundry industry.

Skilled labor shortage has been decried for many years and attempts have been made to make up for it by engineering skill requirements out of the worker's hands into the equipment . . . by conducting promotional programs in high schools and among civic groups . . . by instilling pride of craftsmanship in potential apprentices and providing them with a thorough training program . . . by pointing to the supervisory positions which will eventually open up to the qualified journeyman. Some few—too few—shops are making it possible for certain apprentices to broaden their background by continuing their education at an engineering school, thus providing added inducement to enter the trade.

There's no pat answer to the problem of securing and training workers. But there seem to be several fruitful fields which have not been worked over so thoroughly that they can't be tackled again. This is particularly true in the case of the high schools, technical schools, and vocational schools. In most such schools, too few of the vocational guidance counselors are familiar with the career possibilities in the field of pattern and casting production. Consequently, they are unable to answer questions put to them by students or to properly present foundry industry opportunities in a brief run-down of job possibilities open to a student.

Foundrymen are overlooking a good bet in failing to contact high schools in their own areas, to tell the Foundry and Pattern Story. This should be done regularly and frequently. First contact might well be made with the top local educational authorities so they'll be acquainted with the industry, its personnel needs, and how they might be met.

Invite educators to a meeting staged primarily to get the Foundry and Pattern Story across. Hold open house in the shop for educators so they can tell the students about it. Reach the parents through PTA meetings, civic groups, service clubs, a general open house. If a community open house can't be staged, at least bring in the students. Show them how vital castings are to everyone's welfare . . . how castings are made . . . what the plant does for the community through jobs provided, taxes paid, services and materials purchased.

Recruiters who contact colleges long ago learned not to wait until graduation to secure the men they want. Even now they're out looking over the 1954 and 1955 crops of graduates. The same technique can be applied to high schools. Foundries should be looking now to the June 1954 high school graduating classes. At the same time, the January 1954 classes that will be coming out in the larger cities should be given attention.

The Foundry and Pattern Story is one of the most interesting and ancient tales to be told. The future promises to be even more interesting as new materials, processes, and equipment come into use. Foundrymen have only themselves to blame if the story isn't told and capable workmen are lost for failure of the telling.

Robert Langsenkamp.

ROBERT LANGSENKAMP, *President,*
Langsenkamp-Wheeler Brass Works

High-Speed Control With Automatic Sand System

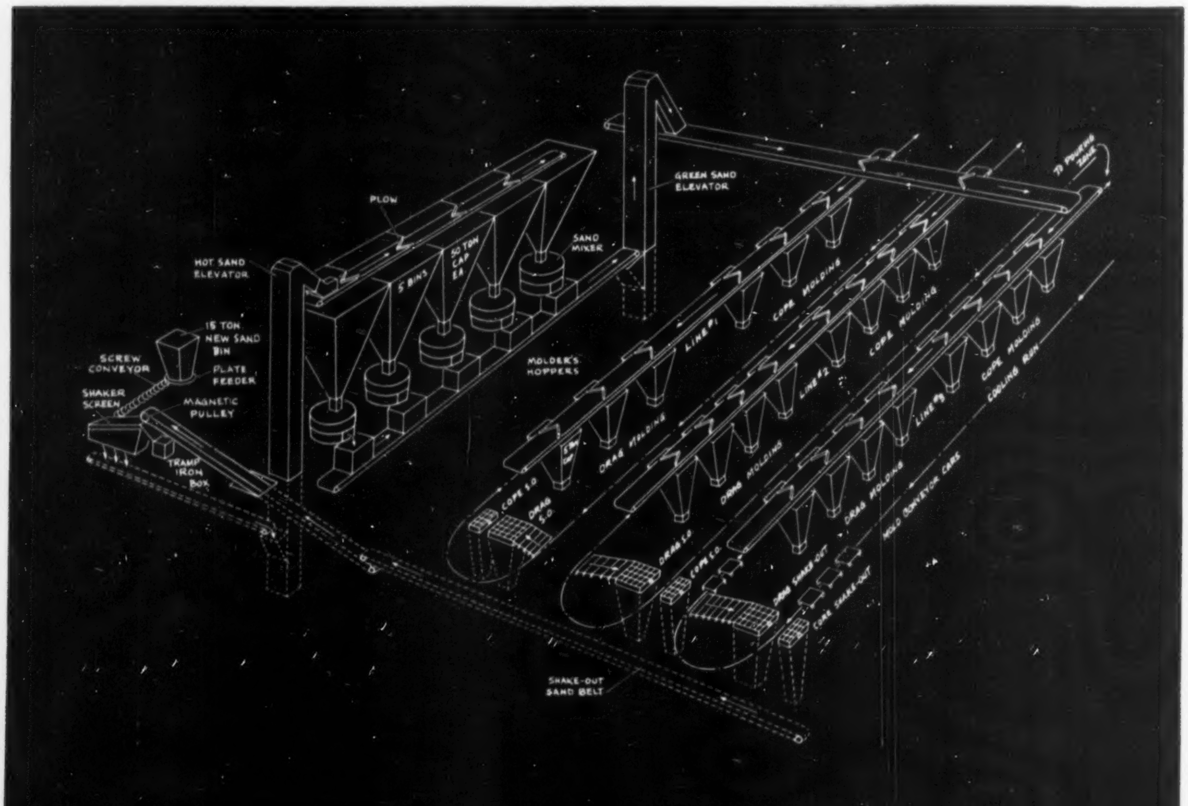
■ At the Kelsey-Hayes Wheel Co. foundry in Detroit, 200 tons of sand are in constant circulation throughout the sand system. Used 16 times during each two-shift day, the sand in the circuit requires the equipment necessary to handle the equivalent of 3200 tons of sand in approximately 16 hours. Absence of space for surge bins made it desirable to install a system capable of handling 240 tons an hour in order to give flexibility needed when the sand system must either absorb excess sand or supply more than the usual demand.

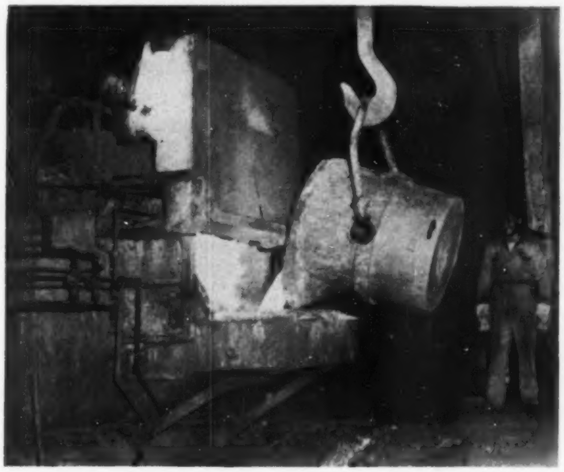
Five sand mixers are pushed constantly to supply the three molding lines which produce some 60 per cent of the brake drums cast in the plant. Balance of production is made centrifugally by pouring molten iron into spinning steel shells which become an integral part of the drums. Cores, other than strainers, are not used in either type of production so sand losses are made up by additions of eight to 15 tons daily of a mixture of sharp sand and bank sand.

A high degree of uniformity in sand properties is required in the high-speed operations. Keeping the sand constant and varying the number of jolts to suit the castings being produced is considered by Foundry Superintendent John Sulga to be preferable to changing sand mixtures. This makes automatic sand conditioning the heart of the sand circuit.

Until automatic sand control was installed, sand properties and workability were controlled as well as possible by making bond additions by scoop, mois-

Sand circuit in the Kelsey-Hayes Wheel Co. foundry, diagramed below, shows how 200 tons is kept moving to keep the three molding loops supplied with the equivalent of 3200 tons of sand in each two-shift day.





Metal for the centrifugally-cast brake drums is duplexed in a direct-arc electric furnace after melt down in one of the plant's two 102-in. cupolas.

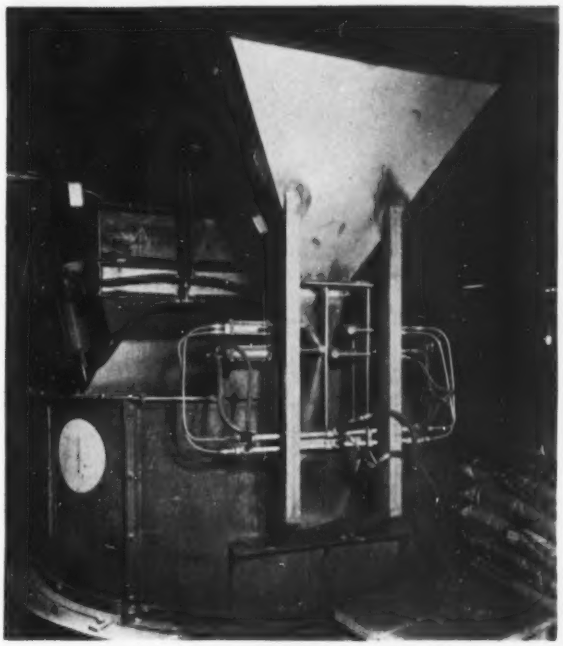
ture additions by feel, with periodic checks by the sand laboratory. Since the mixing cycle is only 45 seconds—including loading and discharge—there was no time for making changes if the mixer operator made an error. Now one of the five mixers is fully automatic and the other four are rapidly being converted.

Typical sand test data showing how the sand is automatically tempered in spite of variations in moisture and temperature of return sand are shown in Table 1.

The automatic sand conditioning facilities consist of five integrated control mechanisms: a hopper control unit that automatically operates the sand plows above the return sand storage bins; a sand temperature unit that measures the temperature of the hot sand and automatically adds the correct amount of water needed to replace that lost through evaporation; a continuous moisture measuring unit that checks the incoming sand and adds the amount needed for tempering; an automatic bond measuring and addition device; and a control that governs all steps in the sand preparation sequence.

TABLE 1—COMPARISON OF RETURN AND CONDITIONED SAND WITH AUTOMATIC MOISTURE CONTROL

Return Sand		Conditioned Sand
Moisture, %	Temperature, F	Moisture, %
2.00	132	3.8
1.80	132	3.7
1.95	135	3.8
1.95	132	3.8
2.20	132	3.7
2:25	135	3.7
1.80	140	3.8
2.25	135	3.7
1.10	140	3.8
1.50	148	3.6
1.60	150	3.8
2.00	135	3.8
1.90	135	3.8
2.00	138	3.7
1.70	135	3.8



Bentonite and seacoal are added from hopper. Rubber tubes which lead from bottom of bifurcated hopper are squeezed shut in two places to automatically measure, then release desired quantities of sand additives.

The No. 1 mixer has its 50-ton bin of sand kept stocked by automatic control of the first plow on the return sand belt. Electronic probes in the bin use radio frequency capacitance to raise the plow when the bin is full and lower it to deflect some of the return sand when the bin is only about one-third full.

While a batch of sand is being mixed and discharged, the control equipment that determines the amount of water required for the next batch is in action. A probe in the batch hopper converts the hopper and sand into a huge electrical condenser. Average moisture content of the entire hopper load is determined because the entire batch of sand is involved in the measurement. Incoming moisture is measured and the value is automatically relayed to a small water dispensing tank which then stores the water needed to bring that batch of sand up to temper.

Simultaneously, a pyrometer measures the temperature of the sand and indicates to the dispensing tank the additional amount of water needed in the mixture to compensate for losses during mulling, conveying, and storage.

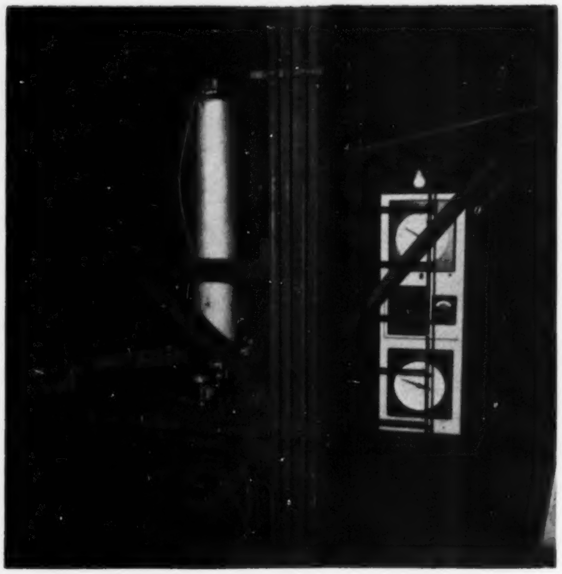
At the start of a new mixing cycle, the discharge door of the mixer has just closed. The dispensing

Closest of five sand mixers is already fitted for automatic sand control. Other four soon will be.

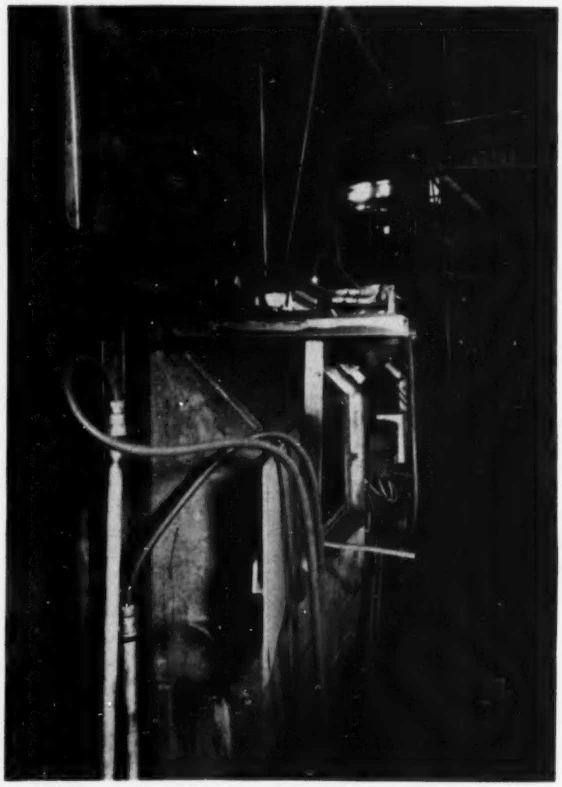
Transfer-ladle operator stands back as pourer fills spinning molds to cast brake drums centrifugally.

tank immediately sprays the correct amount of water into the mixer. This is followed by the measured load of sand (1200 lb). The mixer wheels operate continuously, never stopping as long as the sand conditioning and distribution system is in operation.

Binders are added by means of a double-barrelled unit consisting of a divided hopper terminating in two rubber tubes about four inches in diameter. The tubes serve as measuring chambers for the two sand additives. In use, the tube is squeezed shut near the lower end, filling with bentonite or seacoal by gravity. When squeezed off near the hopper, the tube has automatically measured the desired volume of material which is released into the mixer when the lower end of the tube is allowed to open. The tubes



Equipment in cabinet at right translates measurements of sand in measuring hopper into correct amount of water needed to compensate for evaporation losses and to give desired temper. Proper amounts of water are stored automatically in tank at left to be released into mixer.



Probes in foreground measure height of sand in bin. Upper probe indicates to mechanism in center when bin is full and plow on hot sand belt automatically raises. When bin is one-third full, lower probe takes over and signals need for more sand.

Cupola metal is tapped continuously into 5-ton U-shaped fore-hearth. Molten iron is inoculated in transfer ladle with crushed graphite and lump ferrosilicon.

Weights on overhead conveyor are gradually lowered to rest on molds at pouring stations, then raise and come back to pouring area in closed circuit.

are squeezed by bars actuated by air cylinders; positions of upper and lower cylinders are adjustable within wide limits to permit accurate measurement over a considerable range.

After mixing, the molding sand discharges automatically onto the prepared-sand belt which runs under the line of mixers to the boot of an elevator. At the second floor level, the elevator discharges onto a cross belt that distributes prepared sand to each of the three molding lines. Molds are made on cope and drag machines located inside the molding loops. Each molder is supplied with sand plowed from the overhead belt that feeds his molding line. A continuous, power-driven mold conveyor receives drags, then copes to complete the molds, and carries them to the pouring area where weights are synchronized to lower onto the molds just prior to pouring.

Shakeout Is Automatic

After cooling for approximately half the distance around the loop, copes are shaken out and returned by gravity to the cope machines. Around the end of the loop, drags are automatically moved onto the shakeout, and returned to the drag machines by roll conveyor. Used sand falls through the shakeout grate onto an under-floor belt that also collects spill sand and unused sand that comes over the end of the distribution belt. Spill sand is caught on a belt (one for each molding line) running under the grating that forms the floor around each molding machine. The relatively high proportion of sand to metal in each mold makes it safe to drop shakeout sand directly onto a belt rather than onto a metal conveyor.

After receiving sand from all three pairs of shakeouts, the hot sand belt discharges onto an inclined belt with a magnetic head pulley. The sand drops onto an inclined shaker screen that breaks lumps and removes any non-magnetic material that may be present. The sand then drops to the return belt where it is joined by the small amount of new sand added daily. New sand is added by way of a screw conveyor fed from the rotating plate feeder of a 15-ton cylindrical bin.

New sand is received in open cars, unloaded by clamshell bucket into a concrete bin, and from there into the cylindrical new-sand bin. Railroad cars and bins, along with all other materials storage areas, are under roof.

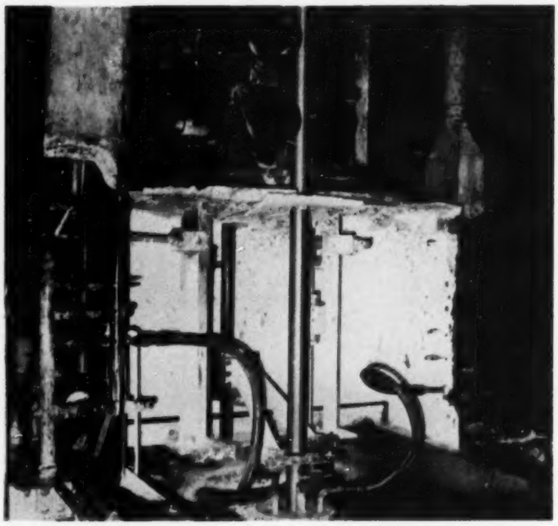
Electrical Interlock Protects Equipment

The return belt empties into the boot of a double-bucket elevator that carries the hot sand up to the five 50-ton mixer storage hoppers and the cycle starts all over again.

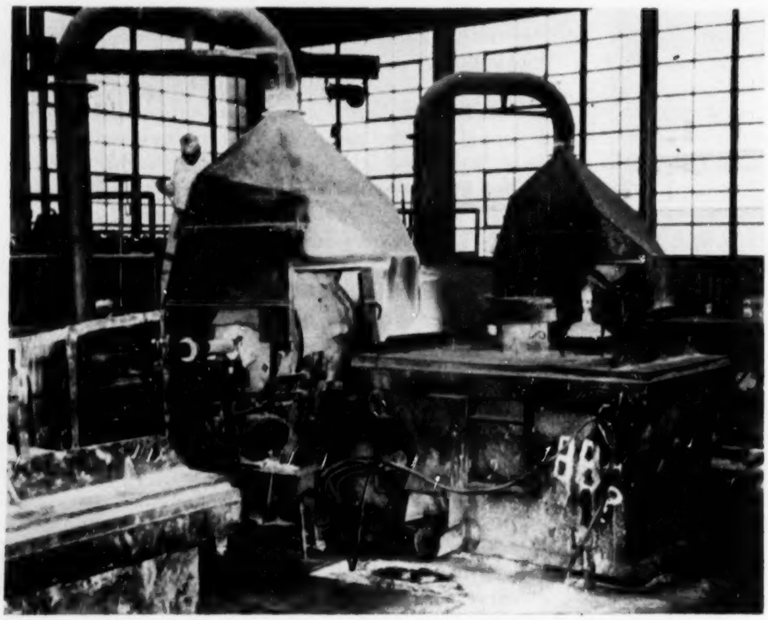
All sand conditioning and handling equipment is interlocked with zero-limit switches which will stop the entire system in case any one of the belts or elevators stops.

Continuous Casting of Copper-Base Alloy Stock

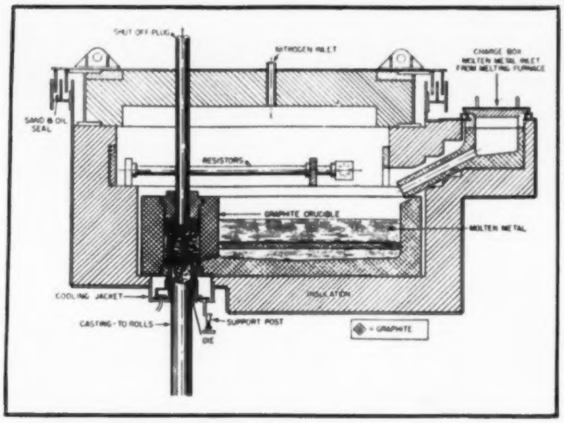
■ Continuous casting of copper-base alloys at the Barber, N. J., plant of American Smelting & Refining Co. puts solidification on a nearly ideal basis. In the process, solid metal is continuously withdrawn from the bottom of a self-lubricating, water-cooled graphite die. From above, molten metal under a nitrogen atmosphere keeps the die filled and prevents formation of shrinkage cavities. Freezing from the bottom upwards is ideal for permitting escape of any dissolved gases liberated during solidification.



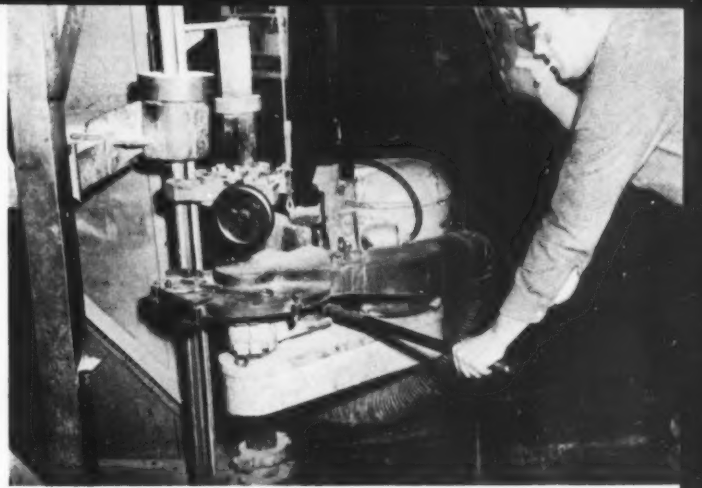
(Left) Charges for specific bronze alloy are shown on floor in foreground, ready for loading into charge boxes and hoisting to melting floor. (Above) Bronze bar, at top is shown leaving bottom of water-jacketed graphite die, already solidified to size.



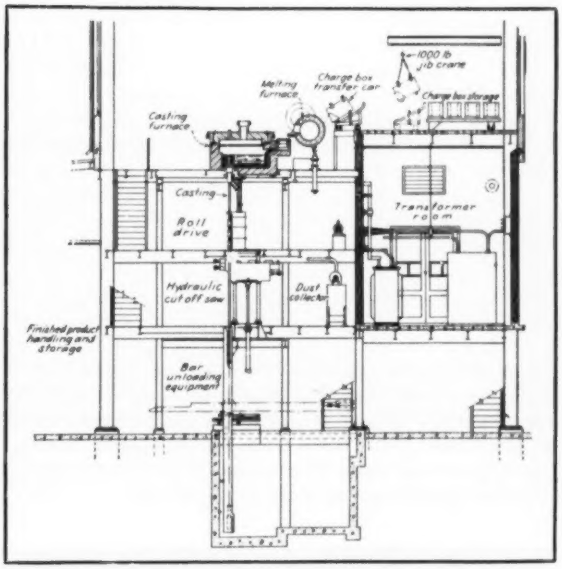
At left is a rotary furnace, used for melting in this continuous casting plant. Molten bronze is poured from this unit into the holding furnace, which encloses casting crucible (at right in photo). From crucible, the metal enters the graphite die, under a gravity feed system.



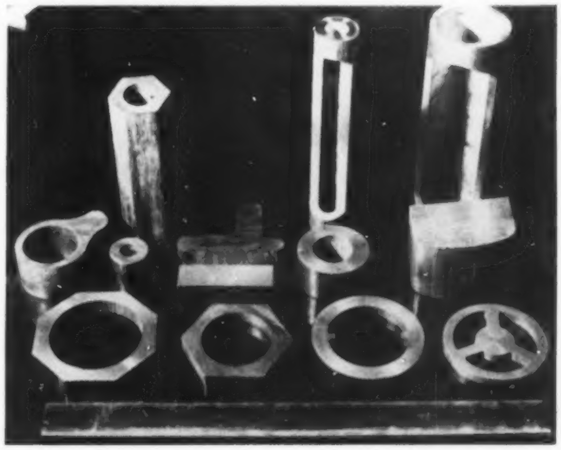
Schematic drawing above provides cross-sectional view of holding furnace, or crucible and die arrangement, used in continuous casting process. A nitrogen atmosphere is maintained in the furnace.



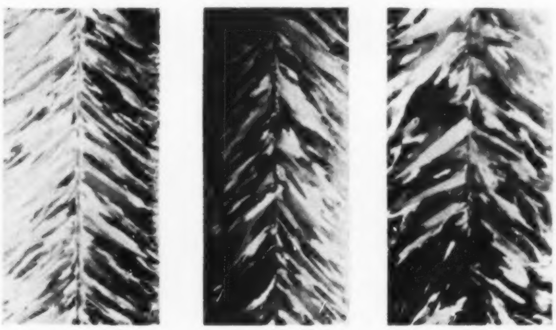
Cutting to customer specifications is accomplished by clamping this traveling saw to bars. Maximum length is 20 feet. Note that two small diameter bars are being cast at same time. Up to five bars can be produced simultaneously, depending on diameter.



The cross-sectional drawing reproduced above shows all of the major elements used in the Barber, N. J., continuous casting plant of American Smelting & Refining Co.



Pictured are a few examples of wide variety of bars, tubing and shapes regularly cast to customers' specifications at American Smelting & Refining Company's casting plant.



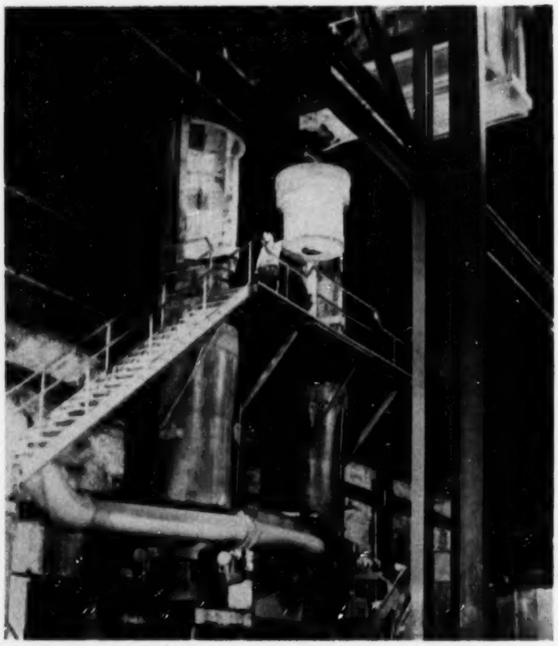
"Chevron" pattern is characteristic of microstructure of continuous cast bar, tubing and shapes. From left: 75-5-20 alloy bar 1¼-in. diam.; 85-5-5-5 alloy 1⅛-in. diam.; and 88-10-2 alloy 1¼-in. diam.

Graphite dies shown above are typical of those used in the continuous casting process.

K. F. Lange

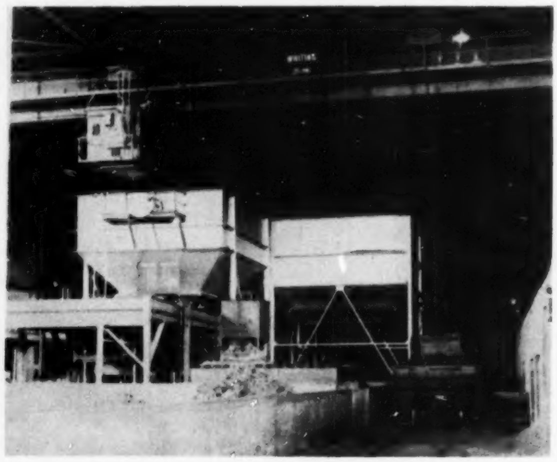
Planning A System For Materials Handling

KENNARD F. LANGE / *Sales Manager, Link-Belt Co., Chicago*

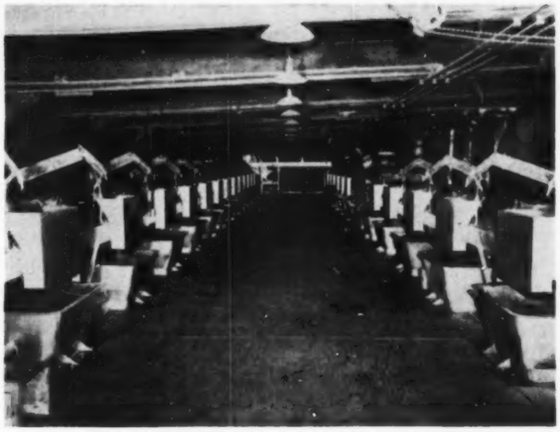


Cupolas in duplexing system are charged by bucket and traveling crane. Bucket is normally loaded by gravity from nearby hoppers.

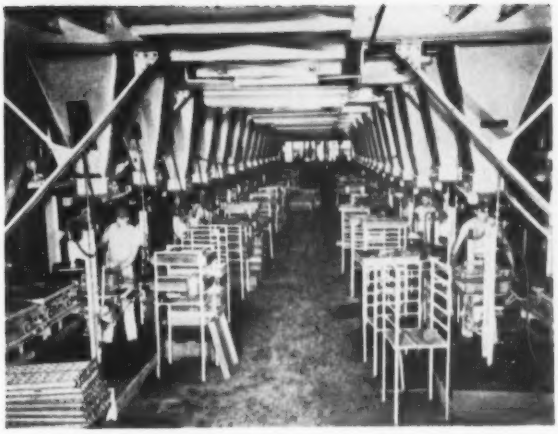
To produce one ton of good castings, some 150 to 200 tons of material are handled and rehandled, requiring 40 to 50 per cent of the total time expended in the shop. The author gives an approach to these conditions in a paper presented at last year's Metals Casting Conference at Purdue University.



Material unloading and charge make-up system for cupolas at left. Overhead crane keeps hoppers loaded by means of clamshell for coke or electromagnet for metal.



Overhead sand distribution system in Ohio malleable iron foundry. Plows are lowered to deflect sand from conveyor belt to meet needs of molders



Molding lines and mold conveyors on ground floor show lower ends of sand hoppers pictured at left and racks for convenient storage of cores adjacent to molders.

■ The fundamental steps to consider in formulating a materials handling system in any foundry are:

1. An accurate analysis must be made of capacities required to meet the sales potential. This is determined through a careful survey by the Sales Department of existing and potential markets that can be serviced economically from the locality.

2. A careful study should be made of present equipment. This would also include present building facilities, if, as in most cases, the study is for an existing foundry. If the foundry contemplated is an entirely new plant, then consideration of present equipment, of course, is not an issue.

3. A study must be made to try to obtain straight-line flow in the production processes from the entrance of raw materials in the plant to finished castings leaving the shipping room.

4. Develop a flow sheet layout for study and discussion with the foundry personnel including foundry superintendents, foundry engineers, and the entire top administrative staff.

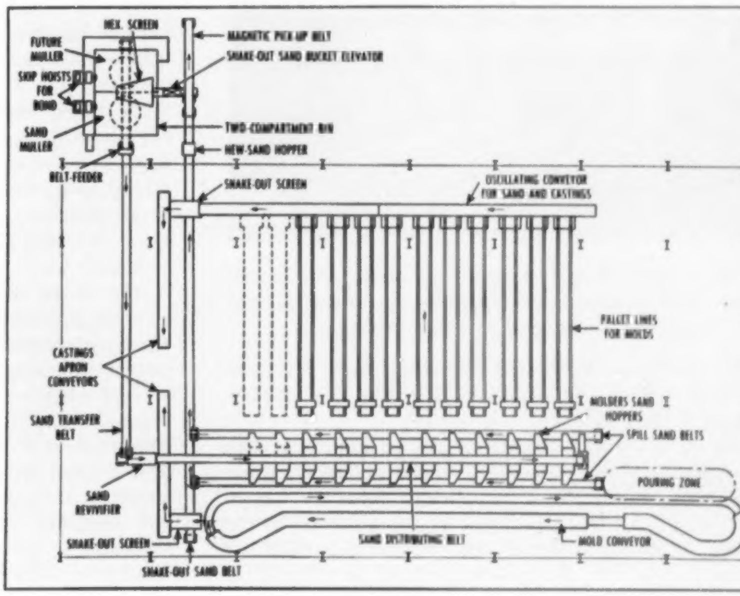
5. After a desirable flow has been established, a more detailed layout can then be developed. In developing this layout, each department should be studied separately, making large scale layouts involving equipment and operations essential to that department. These separate layouts can then be integrated into the final layout.

Raw Materials Handled in the Foundry

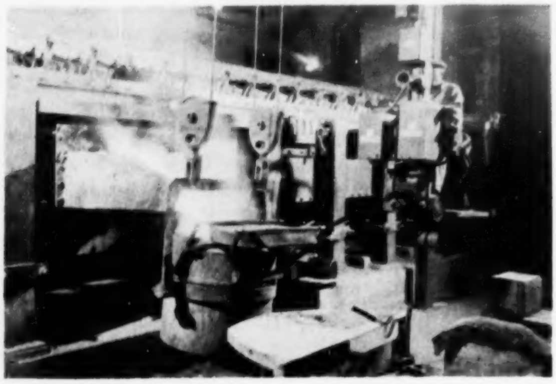
The principal raw materials entering the foundry are pig iron, scrap iron, limestone, coke, and various grades of sand.

The conventional and most practical way of handling pig iron and scrap iron, depending upon the size of operations and the physical limitations of yard facilities, is by electromagnet. The electromagnet is generally used in conjunction with an overhead yard

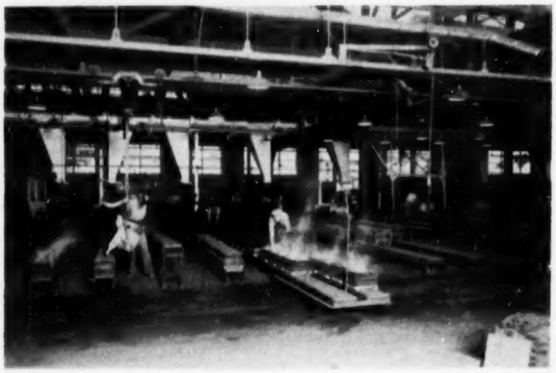
General arrangement of sand, mold, and castings handling system in use in West Coast plant.



Overhead trolley conveyor for handling cores from storage to continuous mold conveyors.



Iron is shown being tapped from duplexing air furnaces into bull ladle servicing mold conveyors. Note operator of bull ladle rides with the ladle.



Molders in this shop store completed molds on roll conveyors. After pouring, molds are shifted to transfer car and moved to shakeout at end of foundry.

crane, spanning the entire unloading area. In some instances where the capacity is small, the electromagnet is used with a crawler crane.

One of the major considerations in handling coke is to keep breakage down to a minimum since a great proportion of the small particles of coke are wasted and carried to the atmosphere by the air blast in the cupola. Wherever possible, and where quantities are sufficient, probably the best method yet developed for unloading foundry coke to storage is by means of an automatic skip hoist receiving the coke from bottom dump hoppers and very gently elevating the coke to a belt conveyor that will deliver the coke to storage bins.

In some instances, it may be possible to use belt conveyors entirely as an elevating medium, as well as a conveying medium. This, necessitates considerable space in which to gain height with the belt conveyor. While it is good practice to run the belt conveyor as nearly horizontal as possible in order to eliminate spillage, it is feasible to handle foundry coke on a belt conveyor running at an inclination of 17 degrees.

Can Use Elevator for Coke

In some instances, elevators are used to elevate coke. An elevator should be used only when a skip or a belt conveyor will not fit into the existing layout. An elevator will crush the coke and make considerable fines, and even with the utmost precautions the coke will occasionally jam in the elevator and cause shutdowns to the equipment. If an elevator is used, it should be of a continuous bucket-type running at a slow speed of approximately 85 fpm.

Limestone can be handled over the same conveying system used for coke. The detrimental effect of handling limestone in an elevator is of no great importance. Limestone can also be handled by either an overhead traveling bridge crane with a clam shell bucket or a crawler crane equipped with a clam shell bucket.

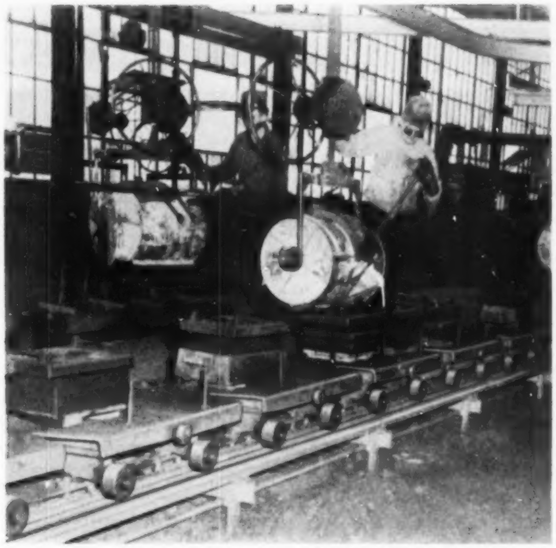
Sand normally enters the foundry in box cars or hopper-bottom gondola railroad cars. Sand received in box cars can be handled by means of a power shovel which mechanically scoops the sand into a receiving hopper in front of the box car door. The sand then is fed from the hopper by means of a belt feeder and is elevated and conveyed to the proper sand storage bins. When sand is received in a hopper-bottom car, the sand is discharged through the gates into a hopper located under the railroad tracks and then is conveyed in the same manner as described above. It is good practice to design the hopper large enough to accommodate either box car unloading or hopper-bottom car unloading.

Cupola Charging and Charge Makeup

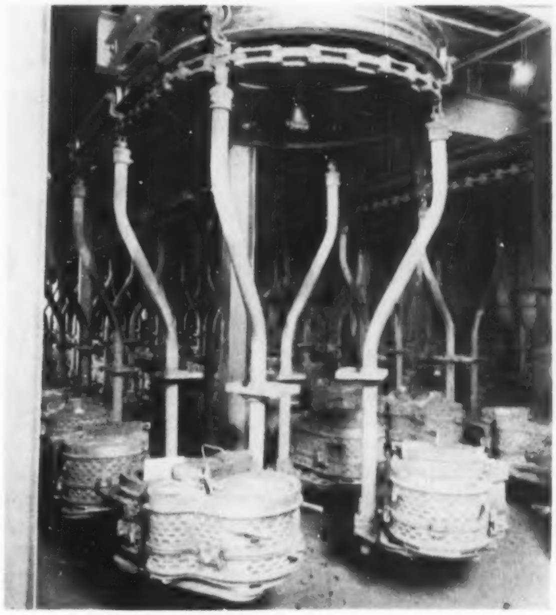
One of the major material handling problems in the foundry is making up the charges for the cupolas and charging this material into the cupolas. In a very small foundry, making up the charges by hand and even charging the cupola by hand is still the most practical way.

The next most common method of charging a cupola is by skip hoist. The skip bucket is generally flush with the charging floor and can be made to serve one or two cupolas. The charge can be accumulated in several ways and deposited into the skip. The most common way is to make up the charge in a container mounted on a car and convey the charge to the skip. The charge can be put into these containers by hand methods or through overhead storage employing scales for weighing each ingredient.

Probably the most efficient type of charge makeup, where capacity justifies such an installation, is by



Molds on car-type mold conveyor pass pouring station of Indiana foundry. This is part of complete sand and mold handling installation.



Pendant-type mold cooling conveyor snakes back and forth through Michigan foundry between pouring area and shakeout while castings cool to shakeout temperature.

means of a charge makeup conveyor. The ingredients to be used in making up the charge are stored directly over a circular car-type conveyor. Charging containers are placed on the conveyor cars, and as the conveyor moves into position under the various bins containing pig iron, scrap iron, coke, and limestone, the proper amount of each material, determined by weight, is deposited into the charging bucket. When the bucket has received its entire charge it is picked up from the charge makeup conveyor, elevated by an overhead charging crane, and placed inside the cupola charging door. There, through a drop bottom device, the contents are discharged into the cupola.

Core Room Sometimes Neglected

In the majority of foundries, considerably more attention has been given to molding operations than to operations in the core and finishing departments. This is only natural since the molding operations represent a larger potential for savings in direct labor. However, core room and finishing room operations consume a great amount of indirect labor in handling and rehandling of materials that should not be overlooked. They warrant careful study to eliminate bottlenecks and backtracking.

Raw materials necessary to core making should be stored where they will be handy to the core sand preparation plant. Core sand is generally prepared in a batch type mixer. Small foundries may load different ingredients by hand into the mixer or into a skip charger servicing the mixer and then discharge the prepared core sand directly from the mixer into a container. The container may be a wheelbarrow or a box which is then carted to the core making area for distribution to the core makers.

In other core rooms, sand is distributed by drop bottom buckets traveling on overhead monorails and discharging into the core maker's hoppers. In large core rooms, a complete sand storage bin containing the various types of sand necessary for making core sand is located above the mixers. All the ingredients are weighed automatically before discharging into the mixers. After the sand is prepared, it is discharged into a hopper located below the mixer from where it is elevated and conveyed by belt to the respective core maker's hoppers. Different batches of core sand may be prepared and stored in separate hoppers.

During the last few years, core blowers have been widely used. There are now many small cartridge type core blowers for the production of small quantities of cores which would not prove economical to set up in a large core blowing machine. Cores are also made by hand methods on benches, as well as on jolt machines. For jolt machine and core blower operation the core maker is usually furnished with overhead sand storage.

Continuous Core Oven Advantages

Selecting the proper type of core ovens is a problem in any core room. Most foundries, particularly those making diversified types of castings requiring large cores as well as small cores, will find that a batch type oven is very practical. A batch type oven gives considerable flexibility. A foundry may want to use a continuous type oven in addition to a batch type oven. The continuous oven offers many advantages from a material handling standpoint, due to the fact that cores can be conveyed from the coremaker to the oven in a straight-line flow and the baked cores can be taken from the core oven at the opposite side. All these operations are continuous and not intermittent as is the case in a batch oven. Conveying mediums in the core room for handling cores are

These 42-in. wide channel-top apron conveyors handle castings from shakeout. After cooling, castings are sprued on conveyor, sorted, and put in containers. The sprue is discharged over head-ends of conveyors into trolley conveyor buckets.

Sorters remove hot castings from apron conveyor which leads from shakeout in Illinois foundry.

gravity roll conveyors handling pallets of cores to and from the core ovens, flat-type belt conveyors, and fork trucks or manually pushed carts.

While some of the larger foundries utilize trolley conveyors for transporting cores to the molding stations, a smaller foundry will truck the cores to the molding stations by means of core carts or lift trucks. There should be an ample active core storage section adjacent to the molding stations without projecting into the aisleway.

Sand in the Molding Department

The greatest amount of material handled during the molding operation consists of sand. Starting at the shakeout, the mold is shaken out by means of a vibrating screen that separates the sand from the metal, the sand falling through the screen into a hopper located below the shakeout screen. The sand is fed from the hopper at a uniform rate by either a belt feeder equipped with a magnetic pulley, a vibrating feeder, an apron feeder, or an oscillating feeder. After magnetic separation is made of the sand and tramp iron, the sand is elevated, in the majority of instances, by a bucket elevator discharging to a sand screen located above the shakeout sand storage bin. This sand screen may be either a vibrating screen or a hexagonal revolving screen depending upon sand conditions and the results desired from the screen.

The screened sand falls into the shakeout sand storage bin and is withdrawn from the bottom of the bins by either gates to batch hoppers for measurement, or by mechanical means such as belt feeders or apron feeders. The sand then enters the mixers for conditioning. In most cases, the prepared sand is cooled during the mixing cycle. The prepared and cooled sand is discharged from the mixer to a hopper. Prepared sand is fed from this hopper by means of belt feeder to a bucket elevator which discharges the sand to a revivifier. The revivifier imparts flowability to the sand and discharges the sand onto a belt distributing conveyor in an aerated condition.

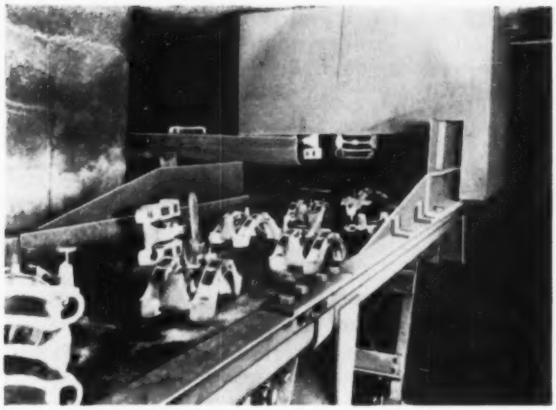
In the past, flight conveyors were used for distributing sand to the molders while today the general practice is to use belt conveyors for this purpose. Sand is plowed from the distributing belt conveyor into the molders' hoppers where it is withdrawn to fill the flask by means of gates, belt feeders, or apron conveyors. In some instances, instead of using a distributing belt, sand is conveyed to the molders' hoppers by means of a bucket traveling on a monorail located over the hoppers. In some smaller foundries, sand is handled from the mixers in wheelbarrows; in other foundries, the prepared sand is handled in a container and is transported and discharged into the molders' hoppers by means of high-lift fork trucks.

Sands Behave Differently on Belt

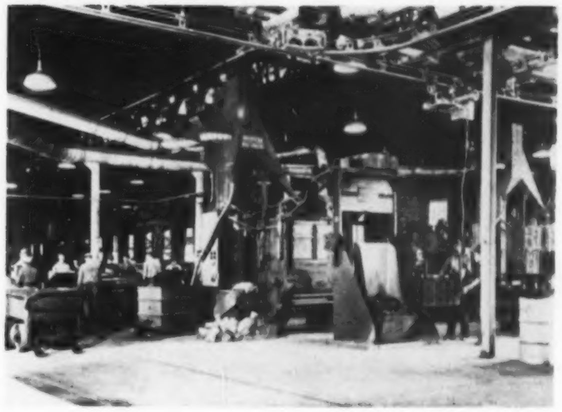
Some foundries are designed so that a bucket elevator is not required; these foundries use a belt conveyor instead of a bucket elevator. When using a belt conveyor, a great deal of room is required to gain the necessary elevation to the shakeout sand storage bin or from the sand plant to the distributing belt. Shakeout sand can normally be conveyed on a belt conveyor at an angle not to exceed 18 degrees; a prepared-sand belt conveyor should not exceed an angle of 23 degrees. There are many instances where these angles have been increased and satisfactory operation has been experienced; shakeout and prepared sand vary in each foundry, and they do not all behave in the same manner.

The molding machine is the heart of the molding operation, and the set-up around the molding machine should be studied carefully to obtain the most efficient utilization of men and equipment. A full scale dress rehearsal of all molding operations should be set up to determine the best possible layout at this point.

After the molds are made they are either set on the molder's floor by hand, placed on gravity roll conveyors that will convey the molds from the molding position to the pouring station, placed on pallets that run on gravity roll conveyors, or on pallets equipped with small wheels running on angle tracks. Or the molds may be placed directly by the molder onto a



Oscillating-tray conveyor handling castings and sand. Four conveyors of this type are in service here.



Castings being handled from annealing containers to airless blast cleaning equipment, then to grinders.

continuous car-type mold conveyor that conveys the molds to the pouring, cooling, and shakeout stations.

Must Consider Many Factors

Many factors are to be considered before arriving at the type of mold handling that is best suited to a particular foundry. One of the most important considerations is whether the melting is continuous throughout the molding hours or whether there is considerable lag from the time molding is started until pouring begins. Many foundries may mold for three to four hours and then start pouring and pour for the remaning four to five hours of molding time. Some smaller foundries will mold approximately six hours and then the molders will pour off during the remaining time. Production foundries will pour and mold simultaneously throughout the day.

Only with continuous pouring can a car-type mold conveyor be employed. The continuous car-type mold conveyor is the ultimate for securing production, economizing in space, securing the best shakeout conditions through a central shakeout station, securing the best conditions for dust and fume control, as well as for pouring. Less manpower is required for continuous mold conveyor operation than any of the other methods described above. However, storing molds on the floor on gravity roll conveyors, or on pallet type conveyors, is certainly much more flexible than a mold conveyor for cooling and for available storage space in case of interruption in melting or pouring.

Casting Cooling Methods

Castings coming off the shakeout screen are cooled by one of the following methods. Smaller foundries may shakeout on the floor and let the castings cool on the molder's floor or place the castings in containers for cooling. In large foundries, castings are handled from shakeouts on casting apron cooling conveyors or oscillating conveyors where the castings are cooled, sprued and sorted; this, of course, applies to the smaller types of castings. In some foundries, particularly the automotive shops, castings are handled from the shakeout on trolley conveyors. These conveyors, as is the case when handling automotive blocks, sometimes have a length of over a mile and will cool the castings for four hours or more before taking the blocks to the core knockout stations.

Smaller castings are cooled in containers transported from the shakeout by means of a trolley conveyor traveling slowly to secure maximum cooling before arriving at the sorting and finishing room. The casting cleaning room like the core room has not received a great deal of attention by most foundry engineers. Many hours of indirect labor can be saved by careful planning through the casting cleaning and finishing stages. Straightline flow of product should be the aim of this department, as well as in the molding department. Use of roll conveyors, belt conveyors, monorail and light-duty cranes and lift trucks should be employed where feasible. The finished foundry castings are then ready for shipment by rail or truck.

Air Pollution Control Assn. Elects New Officers

The Air Pollution Control Association has elected its officers and directors for 1953-54. New President is Thomas C. Wurts, director, Alleghany County Bureau of Smoke Control, Pittsburgh, Pa. First vice-president is Gordon P. Larson, director, County of Los Angeles Air Pollution Control District. Other vice-presidents: George A. Davidson, vice-president, Standard Oil Co. of California, San Francisco; W. O. Everling, director of research, American Steel & Wire Div., U. S. Steel Corp., Cleveland; and Charles S. Frost, director, Department of Air Pollution Control, Roanoke, Va.

New Board Members

New Board members are: Harry C. Ballman, smoke regulation engineer, Columbus, Ohio; Ralph W. Bourne, chief engineer, Jefferson County Air Pollution Control District, Louisville, Ky.; John E. Brown, Milwaukee County Air Pollution Control Engineer, Milwaukee; R. L. Ireland, president, M. A. Hanna Coal Co., Cleveland; M. G. Stewart, Washington Terminal Co., Washington, D. C.; and H. L. Wagner, vice-president, Detroit Stoker Co., Detroit.

Fast Polishing Method Brings Out Graphite

R. W. LINDSAY/*Assoc. Prof., Metallurgy, Pennsylvania State College*

J. M. SNOOK/*Westinghouse Electric Corp., East Pittsburgh, Pa.*

Fig. 1—Unetched. 500X. Kodak M plate.

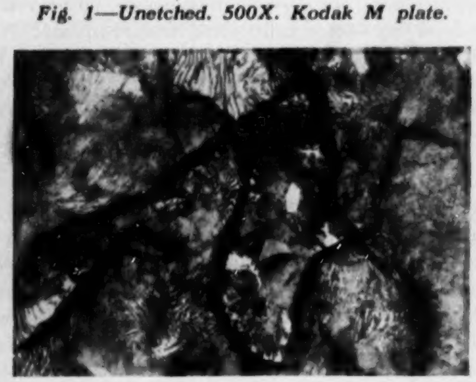


Fig. 2—Picral etch. 500X. Kodak M plate.

A rapid polishing method that brings out graphite structure in cast irons has been developed and applied to a wide variety of irons.

■ Some time ago a questionnaire was circulated throughout many laboratories by an AFS committee on the microstructure of cast iron. The purpose was to obtain information on techniques being used to prepare graphite-containing cast irons for microexamination. An analysis of the replies showed a wide variance in methods of preparation, and in the time required to prepare a sample. Preparation time for a sample varied from as little as five minutes to as much as 45 minutes. Several replies indicated difficulty with polishing, and others were returned with a note to the effect that information on a polishing method for graphite-containing cast irons would be appreciated. Such a method is reported below.

Cutting the Specimen. It is not within the scope of this presentation to discuss the locations at which specimens should be taken. It is assumed that anyone about to select a specimen for microexamination will have definite reasons underlying his sampling of a certain area. A rough sample may be obtained by one of several methods, such as breaking off the sample, cutting it off with a hacksaw, or cutting it out with a torch. The rough sample may be further reduced to a size convenient for polishing, by use of a hacksaw, or by use of an abrasive cut-off wheel. The latter should be of a coarse grained variety, and a water-soluble oil should be used to prevent the wheel from binding during the cutting operation. The final specimen may or may not then be mounted in plastic.

Grinding Operation. The polishing operation is started by grinding the specimen on a belt of 120 grit. It was found helpful to impregnate all grinding belts and papers with graphite. This can be done by rubbing a piece of graphite electrode or rod against the belts and papers.

The specimen is then rotated 90 degrees, and the scratches from the 120-grit belt are removed on a 320-grit belt. The specimen is again rotated 90 degrees, and the scratches from the 320-grit belt are removed by rubbing on 00 emery paper. The specimen is rotated 90 degrees following this, and the scratches from the 00 paper are removed on a 500 X belt. The specimen should be subjected to any one of these operations just long enough to remove the scratches made previously. It was found that the average total time for grinding was approximately 1 minute. This represents the actual time the specimen was in contact with abrasive.

First Wet Polishing Operation. The first wet polishing operation is performed on a silk-covered lap rotating at about 250 rpm, using a thick suspension of chromic oxide as an abrasive. The proper consistency of chromic oxide suspension may be tested by applying some of the suspension to the center of the lap; the suspension should not "fly off" as the lap is rotated at the given speed. The specimen is not rotated in or against the direction of rotation of the lap, but it is moved back and forth along a radius of the lap.

The chromic oxide may be prepared as described in a following section, or the No. 1 grade marketed by the commercial metallographic suppliers may be used. The latter does a satisfactory job, but does not cut quite so rapidly as the abrasive prepared by the authors.

The specimen is polished for about one and one-half minutes, after which it is etched lightly with a four per cent picral solution, and is then repolished to remove the etched surface. This procedure is repeated until the scratches made by the 500 X belt are removed. The average time for this polishing is approximately four minutes.

Second Wet Polishing Operation. The second wet polishing operation is performed on a silk-covered lap rotating at a speed of about 250 rpm, using a thick suspension of No. 1 grade chromic oxide as marketed by the commercial metallographic suppliers. However, if the No. 1 grade has been used in the first wet polishing operation, then the No. 3 grade should be used in this second operation. The proper consistency of the suspension may be tested as described under the first wet polishing operation.

The specimen is rotated against the travel of the lap in this operation, and at the same time is rotated in the fingers. The specimen is polished for about one and one-half minutes, or until the scratches from the first wet polishing operation are removed. The specimen is then etched moderately with four per cent picral and is repolished. The specimen is etched with the picral solution for final examination after this repolishing step. If the appearance of the specimen is still not desirable, it should be repolished and re-etched until the desired appearance is obtained. The average time for the second wet polishing operation is approximately three minutes. (*Note:* the diameter of the lap used in the first and second step was eight inches.)

Preparation of the Chromic Oxide. The chromic oxide

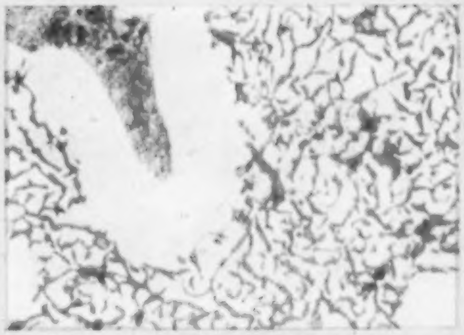


Fig. 3—Picral etch. 500X. Super XX film.

Fig. 4—Picral etch. 500X. Kodak M plate.

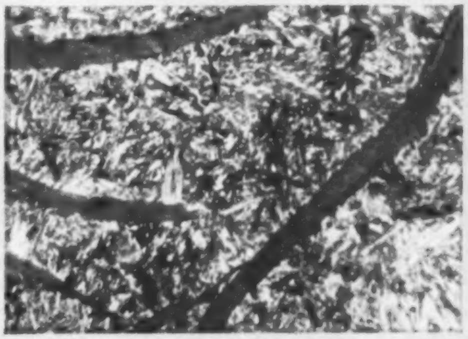


Fig. 5—Picral etch. 500X. Kodak M plate.

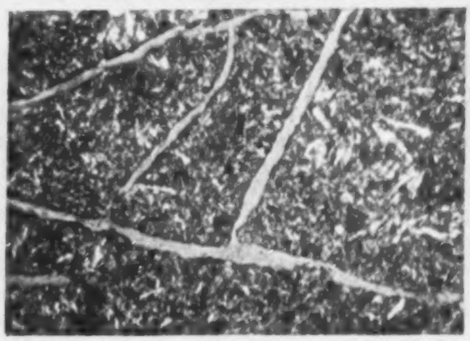


Fig. 6—Picral etch. 500X. Super XX film.

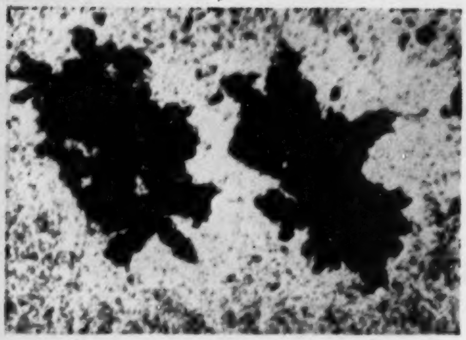


Fig. 7—Picral etch. 500X. Super XX film.

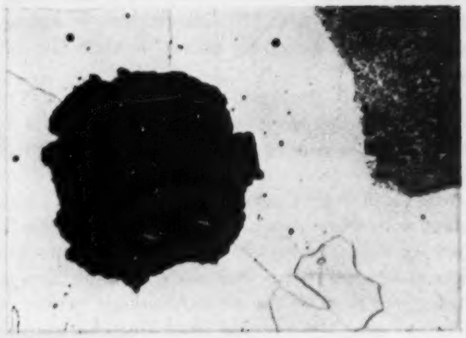


Fig. 8—Picral etch. 500X. Kodak M plate.

used as the abrasive in the first wet polishing operation was prepared in the following fashion:

The chromic oxide was purchased as green tech (nical) chromic oxide from a chemical supply house. This oxide was washed through the screens with distilled water. Screens used were 150 mesh (105 microns), 200 mesh (74 microns), 270 mesh (52 microns), and 326 mesh (44 microns). The chromic oxide that passed through the 325-mesh screen was caught in a large beaker, that was used as a settling tank. After the suspension of chromic oxide had settled for an hour, the water was decanted leaving a sludge of chromic oxide at the bottom of the beaker. The sludge was then bottled and stored for future use. The oversized material remaining on the screens was of little value, and was discarded.

Results. This polishing procedure has been applied to a wide variety of graphite-containing cast irons, and the results are shown in the accompanying photomicrographs. They include a sample taken from the cylinder wall section of an automotive cylinder block (Fig. 1 and 2), a sample from the edge of a heavy section of an automotive cylinder block (Fig. 3), a sample of cylinder block iron made highly ferritic by annealing at 1300 F for 5 hours and furnace cooling (Fig. 4), a sample of gray cast iron oil quenched from 1700 F (Fig. 5), a sample of the same gray cast iron oil quenched and tempered at 1000 F for 1 hour (Fig. 6), a sample of pearlitic malleable iron (Fig. 7), and a sample of as-cast nodular iron made in an induction furnace with a double addition—iron-silicon-copper-magnesium alloy plus ferro-silicon (Fig. 8).

Attention is called to the following points in the photomicrographs: The retention of graphite, be it flake, flake-aggregate (temper carbon) or nodular in form, and of the inclusions; and the detail in the matrix, be it pearlite, martensite, or tempered martensite.

The exposures were made on Kodak M plates or Super XX film, using a green-yellow filter combination. The plates were developed in DK-50 developer. It was observed that the development of the negatives was quite critical and care should be taken to follow the best darkroom techniques. Improper choice of papers, exposure times and developing conditions in printing can spoil the detail apparent in the negatives.

American Die Casting Institute Celebrates 25th Anniversary

The American Die Casting Institute recently observed its 25th anniversary—a quarter-century that has seen the industry grow from insignificance to a quarter-billion dollar annual volume.

Twenty-eight commercial die casting companies joined together in 1928 to form the Institute in an effort to work out an equitable solution to some of the common problems that faced the die casters in those days. Since then, the Institute has performed a wide variety of services for its members in such fields as cost accounting, production techniques, and industry standards. The Institute acted to coordinate defense production of its members during the recent war, and has long worked with industry and educational institutions in technical and industrial research, labor relations, plant safety, and general public relations for the die casting industry as a unit.

The Institute has sponsored advisory committees to work with government through both defense emergencies, and in the difficult days of the 1930s. In 1947, the Die Casting Industrial Research Foundation was merged with the Institute. Such functions remained within the purview of the organization itself until 1952, when it sponsored the formation of the Die Casting Research Foundation.

Various educational and industry-aid publications have been produced. Typical of these was an "Introduction to Die Casting," and a standard cost accounting procedure reference work.

Pressure Casting Film Available

Production details of pressure-cast matchplate manufacture are given in the motion picture "Pressure-Cast Matchplates" recently produced by Scientific Cast Products Co. Just released, the 16-mm, color-sound film runs 25 minutes. It shows how a matchplate is planned and laid out, how multiple-pattern plates are produced from a single master pattern, the casting of the plaster molds, and finally pouring aluminum under pressure. The film can be obtained from Scientific Cast Products Co. at 1390 E. 40th St., Cleveland, Ohio, or at 2520 W. Lake St., Chicago 12, Ill

Building Fund Committee Reports New Contributions

With the authorization by the Board of Directors to open a limited solicitation among the membership of AFS in order to raise the additional $100,000 needed to finance increasing construction costs, completion of a modern headquarters building and Foundry Technical Center in 1954 is assured.

The Building Committee, realizing that the $148,000 contributed in the 1950 fund-raising campaign through the gratifying generosity of over 850 firms, AFS Chapters, and individual members, was not now adequate to finish the project, opened the limited solicitation in October. R. J. Teetor is Chairman of the Committee. Other members are: F. C. Riecks, owner representative in charge of construction; G. H. Clamer; H. S. Simpson; W. B. Wallis; and Walton L. Woody. The AFS Staff Representative and liaison officer for the project is W. N. Davis.

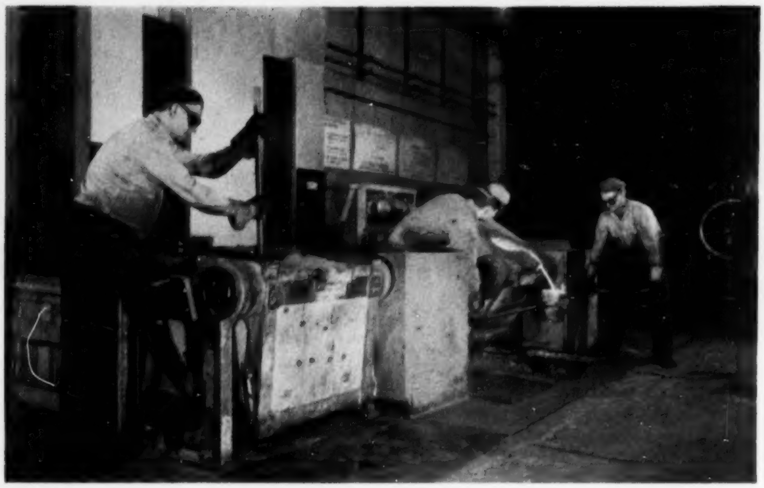
To Be Erected in Des Plaines

It is the expressed purpose of the Society to erect in suburban Des Plaines, northwest of Chicago, a combined headquarters building, and a Technical Center that will serve as the technological hub of the foundry industry in North America. All of the many activities of AFS will be controlled from the Center—activities that are constantly expanding in research, educational service, technical and magazine publication, and the safety, hygiene, and air pollution program.

Early response to the new solicitation indicates that the Building Committee will again be given a vote of confidence by the membership. Here is a list of contributors, as of September 30, 1953. Asterisk (*) indicates an additional contribution to an original pledge.

Advance Aluminum Castings Corp., Chicago
American Foundries Co., Milan, Mich.
***Anderson, Earl, Huntington Park, Calif.**
Baltimore Foundry & Machine Corp., Baltimore, Md.
Barnes, Don, Foundry Supplies & Eqpt., Hamilton, Ont.
***Bonney-Floyd Co., Columbus, Ohio**
***Brillion Iron Works, Inc., Brillion, Wis.**
Carpenter Bros., Inc., Milwaukee
Casting Engineers, Inc., Chicago
Clark Eqpt. Co., Buchanan, Mich.
Cleveland Metal Abrasive Co., Cleveland
Dawes Silica Mining Co., Thomasville, Ga.
Diversey Foundry Co., Geneva, Ill.
***Doe, E. W., Brooklyn Technical High School, Belmar, N. J.**
Engineered Precision Casting Co., Matawan, N. J.
Flockhart Foundry Co., Newark, N. J.
***Gilson Co., J. E., Port Washington, Wis.**
Goltra Foundries, Inc., Barrington, Ill.
Grafton Foundry Co., Grafton, Wis.
Hackett Brass Foundry, Detroit, Mich.
Henry D. J., General Motors Corp., Detroit
Indiana Prods. Co., Kokomo, Ind.
Industrial Metal Abrasives Co., Jackson, Mich.
***Kohler Co., Kohler, Wis.**
Lehigh Foundries, Inc., Easton, Pa.
Leuders Co., Chas. W., Riverton, N. J.
Littlestown Hardware & Foundry Co., Inc., Littlestown, Pa.
Merrin Foundry Co., Minneapolis
Maumee Malleable Castings Co., Toledo, Ohio
Miller's Brass Foundry, Three Rivers, Que.
***National Pattern Works, Inc., Buffalo, N. Y.**
Newaygo Engineering Co., Newaygo, Mich.
Pacific Cast Iron Pipe & Fitting Co., South Gate, Calif.
***St. Louis Steel Casting Co., St. Louis, Mo.**
***St. Marys Foundry Co., St. Marys, Ohio**
San Antonio Machine & Supply Co., San Antonio, Texas
Sand Prods. Corp., Cleveland
Santalite, Inc., Matawan, N. J.
Schneider, Jacob, Schneider Pattern Works, Milwaukee
Sipi Metals Corp., Chicago
***Smith & Richardson Mfg. Co., Geneva, Ill.**
Spiecken, H. J. Jr., Sturgis Foundry Corp., Sturgis, Mich.
Standard Brass Mfg. Co., Kansas City, Mo.
Sturgis Foundry Corp., Sturgis, Mich.
***Utica General Jobbing Foundry, Inc., Utica, N. Y.**
***Wolverine Foundry Co., Detroit**
X-Ray Prods. Corp., North Hollywood, Calif.

The new solicitation has been authorized until the end of the calendar year 1953. Until that time, efforts will be continued to raise the entire amount still needed to meet the full cost of the new headquarters building.



Workers tapping an induction furnace at Allis-Chalmers Mfg. Co.

Carbon in Ferrous Alloys

HARRY K. IHRIG / *Vice-President in Charge of Research, and*
JOHN T. JARMAN / *Assistant to the Vice-President in Charge of Research, Research Laboratories, Allis-Chalmers Mfg. Co., Milwaukee*

H. K. Ihrig

J. T. Jarman

Carbon control is a popular subject for discussion whenever ferrous foundrymen get together. Why it is so important, and how amount and form of carbon influence ferrous alloys are shown by means of a series of experimental heats.

■ Pure iron, if available, would have little use in industry because it has relatively poor physical properties. But the addition of carbon to iron converts it into the most useful and most widely used metal in the world.

The scarcity of certain alloying elements for ferrous metals has focused the attention of engineers on these elements and substitutes for them. Because of the emphasis on the use of nickel, molybdenum, tungsten, columbium and other strategic alloying metals, the importance of carbon as an alloying element is often forgotten. It is by far the most valuable, both economically and technically. Fortunately it is abundant and cheap. The addition of carbon to iron converts it into a metal which can have a wide range of properties obtained by varying the carbon content and the heat treatment. About 90 per cent of the total steel production is carbon steel.

Carbon was first alloyed with iron in prehistoric times. Probably ancient man built a fire on an outcropping of iron ore and after his wood had burned down to charcoal and finally cooled off he noticed globules of metal that were malleable when they were hammered. These iron particles contained carbon from the charcoal. It was only luck when he had just the right amount of carbon present in the iron so that it was strenghtened but was not too brittle. Later, steel was made by carburizing wrought iron and then melting it in a crucible. Today, the carbon content of steel is carefully controlled within a few hundredths of one per cent.

Iron is by far the most widely used metal. Copper, its nearest rival, is used only about one per cent as much as iron. Iron's value to man depends almost entirely on its carbon content. The amount, form, and distribution of carbon in the iron determine the properties of the metal; and the knowledge of how to obtain them has made possible the industrial progress of civilization during the past century.

Carbon Controls Ultimate Hardness

The ultimate hardness and strength of steels depends almost entirely on their carbon content. The term "hardenability," which is widely used in connection with the heat treating of steels, means the depth of hardening in a heavy section rather than the ultimate possible hardness. Various metallic alloying elements in steels increase the *depth* of hardness

rather than the maximum hardness obtainable. The carbon content in heavy sections still determines the ultimate hardness possible. In thin sections the carbon alone is sufficient to give the maximum hardness.

In cast irons, the carbon occurs both as an element in the form of graphite and combined with iron as iron carbide. If iron has less than 1.7 per cent carbon, usually all of the carbon is in the form of iron carbide, and any carbon above 1.7 per cent may be in the form of graphite. It will be shown that the form of carbon present has the major effect on the properties of cast irons.

The carbon in iron and steels comes originally from the coke in the blast furnace. Pig iron contains about 3.5 per cent carbon. Irons and steels with lower carbon contents are made by removing some of the carbon of the pig iron or by diluting it with lower carbon scrap.

Arnold[1] in 1895 showed that increasing carbon gave increasing tensile strengths on normalized steel bars. Nead[2] in 1915 found a similar effect on annealed bars. Abbott[3] in 1915, after a large number of tests, concluded that the Brinell hardness and the tensile strength of a steel are proportional to the carbon content in the as-quenched condition. His values for the higher carbon steels were low, probably because of his inability to thoroughly quench his specimens.

Burns, Moore and Archer[4] in 1938 measured the hardness of a number of samples of various commercial steels and concluded that in every analysis they tested, the maximum hardness obtainable in thin sections was entirely dependent on the carbon content regardless of the presence or absence of other alloying elements.

Effect of Carbon on Steels

Experimental heats of steels and irons were prepared by melting base irons and adding carbon and other alloying elements. The steels were made in a 600-lb induction melting furnace. A killed ingot iron of the following analysis was first melted down: carbon, 0.04 per cent; manganese, 0.21; phosphorus, 0.02; sulphur, 0.02; and silicon. 0.01.

Two keel blocks were poured from the base iron and after each successive carbon addition. Thus, a series of steels with increasing carbon contents was produced from a common base iron. A similar series of alloy steels was produced from the same base iron to which nickel and molybdenum were added. The analyses of the steels are shown in Table 1. The carbon steel heats are numbered and the alloy steel heats have the letter "A" in addition to the number designation.

The sound portions of each keel block were removed and forged to round bars 1-3/8 inches in diameter. These were annealed and then machined into tensile test bars as shown in Fig. 1. Some of the test bars were then heat treated to obtain maximum hardnesses and tensile strengths. The heat treatments and physicals are shown in Table 2. The curves of Fig. 2 show an increasing hardness and tensile strength with increasing carbon content in both the straight carbon and alloy analyses. The effect of carbon on these properties is very small in the annealed samples. This illustrates the necessity for heat treating to obtain high physical property values. Very

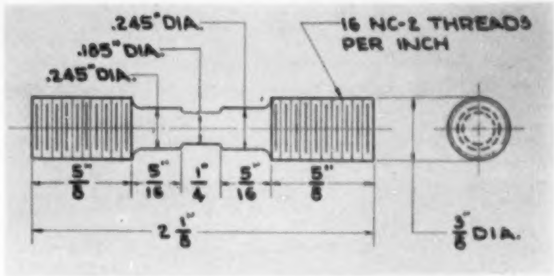


Fig. 1—A typical tensile test bar.

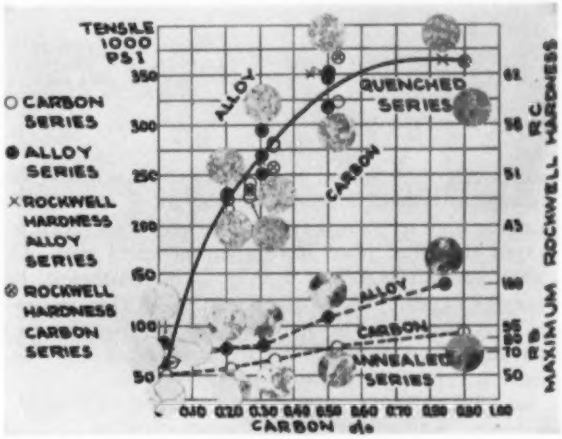


Fig. 2—Relation of tensile strengths and hardnesses to the carbon content in steels.

Fig. 3—Hardness of individual microconstituents. Magnification: 500X.

little is gained by the use of higher carbon steels even in the alloy series if these are not heat treated.

Heat treating gives the structures which are necessary to obtain the physical properties desired. These structures are shown in the photomicrograph inserts in Fig. 2. They are similar for similar carbon contents. The hardness of the individual microconstituents is shown in Fig. 3. The large Tukon indentations are in the soft ferrite or iron phase. They are from 60 to 97 Knoop. The small indentation, which indicates a hard material, is in the carbide constituent of the microstructure. It is 220 Knoop.

Depth of hardening is shown in Fig. 4 and 5. Figure 4 shows the rapid fall in hardness of the carbon

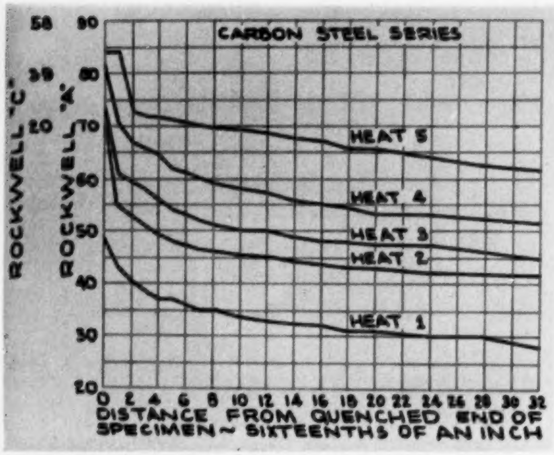


Fig. 4—Hardenability test—carbon steel series.

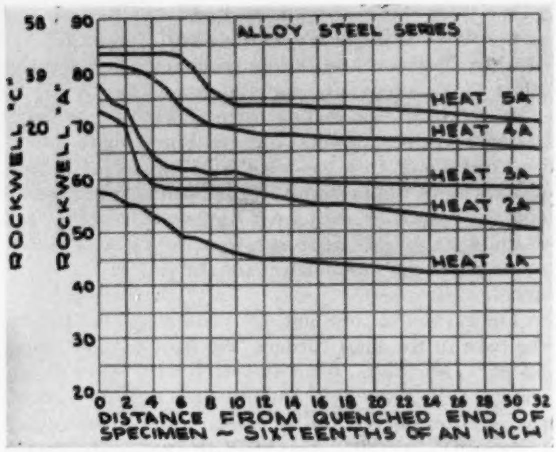


Fig. 5—Hardenability test—alloy steel series.

steels after the initial reading at the quenched end of the specimen. Figure 5 of the alloy series shows similar high quenched end hardnesses but a much less rapid decrease away from the quenched end. The alloy content increases the depth of hardening, but not the maximum possible hardness. In thin sections, carbon steels can be heat treated to give the same hardness and strength as alloy steels of the same carbon content.

Carburization and Decarburization

Carbon may be added or removed from steels without melting them. It is added to the outer layers of steels of carburization. After heat treatment, this provides a strong hard outer layer with a relatively soft and ductile core. Figure 6 shows a gear which has been carburized to give more wear on its surface. It has been ground and etched to show the case. The carburized case has a hardness of Rockwell C-61 but the core is only C-36.

Decarburization is rarely done purposely, but it often occurs during annealing or other heat treatment. The carbon diffuses to the surface and is oxidized. Figure 7 shows an 0.85 per cent carbon steel which has been totally decarburized (light area) to a depth of 0.21 in. It was a test piece as shown in Fig. 1. Its tensile strength was 87,400 psi before decarburization, and 62,250 psi after decarburization. The Knoop hardnesses starting from the top are 88, 89, 150, 210, and 240.

Carbon migrates in steels during welding. Thus, a carbon steel which is being welded with an austenitic stainless steel rod to eliminate the necessity for stress relieving, may have the weld metal embrittled by the diffusing of carbon from the adjoining carbon steel.

Properties Not Affected by Carbon

The modulus of elasticity of steels is not affected by the carbon content and is not changed by heat treatment. Thus the "stiffness" within the elastic limit of all steels is the same regardless of carbon content or heat treatment.

It has been shown that the hot workability of steels is affected little if any by the carbon content[5].

The magnetic permeability of steels with different carbon contents is shown in Fig. 8. In all magnetic fields tested the permeability decreased with increased carbon content. Ductility is reduced with increasing carbon content, particularly in the heat treated condition. Hydrogen under high pressures and temperatures converts the carbon in steel to methane, and

TABLE 1—CHEMISTRY OF CARBON AND ALLOY STEEL SERIES

HEAT	% CARBON	% MANGANESE	% PHOSPHORUS	% SULPHUR	% SILICON	% NICKEL	% MOLYBDENUM
1	0.02	0.20	0.007	0.024	0.01		
1A	0.04	0.14	0.008	0.025	0.01	1.43	0.52
2	0.21	0.10	0.013	0.021	0.008		
2A	0.20	0.15	0.008	0.025	0.01	1.42	0.52
3*	0.26	0.21	0.011	0.025	0.01		
3B*	0.34	0.18	0.007	0.023	0.01		
3A	0.31	0.18	0.008	0.025	0.01	1.39	0.52
4	0.53	0.23	0.007	0.028	0.01		
4A	0.50	0.22	0.008	0.024	0.01	1.40	0.51
5	0.90	0.20	0.009	0.025	0.01		
5A	0.83	0.23	0.008	0.025	0.01	1.39	0.52

*Carbon steel heats above and below carbon 0.31 of Heat 3A

may form blisters or leave voids where the carbon has been[6].

In the hardenable stainless steels, carbon has the same function that it has in the carbon and low alloy steels. For example, it is needed to obtain the necessary hardness for cutlery. In austenitic chromium-nickel stainless steels it has been shown that the corrosion resistance is lowered with increasing carbon content[7]. Figure 9 from Buck et al [7] shows that the corrosion in nitric acid increases markedly even for the very low carbon heats after they have been sensitized at 1200 F for two hours.

Exposure to temperatures of from 800-1500 F of austenitic stainless steels not containing stabilizing elements causes the carbon to precipitate in the grain boundaries. Such temperature ranges are encountered in stress relieving or welding. Chromium migrates into the boundaries. Chromium carbides are formed and these carbides are resistant to corrosive attack. The areas next to them have been partially depleted of chromium to make the chromium carbides, and hence these chromium impoverished areas are attacked. If this attack is allowed to proceed the metal finally becomes a mass of loose crystals because the metal next to the grain boundaries has been dissolved away.

Figure 10[8] shows a grain boundary of a stainless steel with the chromium carbides in the grain boundary and the attacked portion next to this boundary. The carbon content must be extremely low or an element such as titanium, columbium, or tantalum must be added to the steel to preferentially react with the carbon. This ties it up so that it cannot react with the chromium to cause carbide precipitation in chromium-nickel stainless steels.

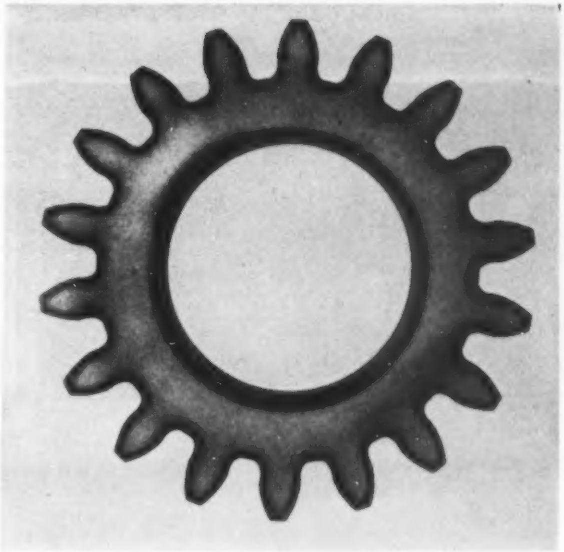


Fig. 6—Carburized gear, ground and etched to show carburized case.

Effect of Carbon on Cast Irons

Three cast irons were prepared. The first heat was made by adding low metalloid steel to pig iron to reduce the carbon content. This iron, when in thin

TABLE 2—PHYSICAL PROPERTIES OF QUENCHES AND ANNEALED STEELS

HEAT	TENSILE 1000 PSI	ROCKWELL HARDNESS	HEAT TREATMENT
1	51.0	54B	Annealed 1800 F., Slow Cooled
1	59.4	78B	Quenched 1800 F., 15% Brine 70 F.
1A	59.0	64B	Annealed 1800 F., Slow Cooled
1A	83.8	88B	Quenched 1800 F., 15% Brine 70 F.
2	56.8	56B	Annealed 1670 F., Slow Cooled
2	218.0	46C	Quenched 1670 F., 15% Brine*
2	225.0	46C	Quenched 1670 F., 15% Brine*
2A	72.4	75B	Annealed 1550 F., Slow Cooled
2A	232.0	45C	Quenched 1550 F., Water 60 F.*
3	228.2	48C	Quenched 1600 F., 15% Brine*
3	243.0	50C	Quenched 1600 F., 15% Brine*
3B	62.3	68B	Annealed 1630 F., Slow Cooled
3B	281.5	52C	Quenched 1600 F., 15% Brine*
3B	280.5	52C	Quenched 1600 F., 15% Brine*
3A	79.2	85B	Annealed 1525 F., Slow Cooled
3A	288.5	54C	Quenched 1525 F., Water 60 F.*
3A	251.0	49C	Quenched 1525 F., Water 60 F.*
3A	271.5	52C	Quenched 1525 F., Water 60 F.*
4	76.6	72B	Annealed 1525 F., Slow Cooled
4	324.0	64C	Quenched 1525 F., Water 60 F.*
4A	108.5	96B	Annealed 1525 F., Slow Cooled
4A	352.0	62C	Quenched 1525 F., Oil 70 F.*
4A	352.0	61C	Quenched 1525 F., Oil 70 F.*
4A	347.5	60C	Quenched 1525 F., Oil 70 F.*
4A	317.0	58C	Quenched 1525 F., Oil 70 F.*
5	95.6	88B	Annealed 1450 F., Slow Cooled
5	- - +	63C	Quenched 1450 F., Water 60 F.*
5A	139.0	24C	Annealed 1525 F., Slow Cooled
5A	- - +	63C	Quenched 1525 F., Oil 70 F.*

*After Quenching, Tempered at 300 F. for 30 Minutes, then Treated at —100 F. 30 Minutes, and Tempered at 300 F., for 30 Minutes
+ Broke in Fillet

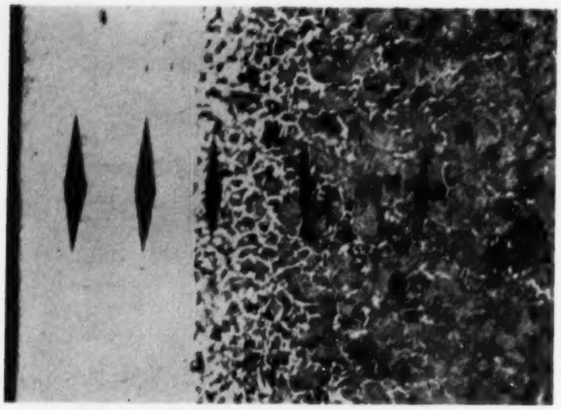


Fig. 7—Photomicrograph of decarburized edge of test bar. Magnification: 100X.

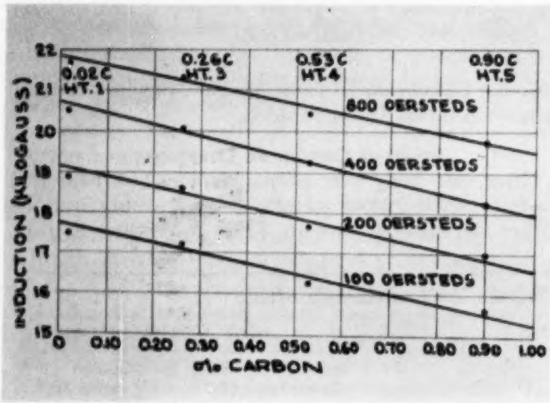


Fig. 8—Effect of carbon on magnetic permeability.

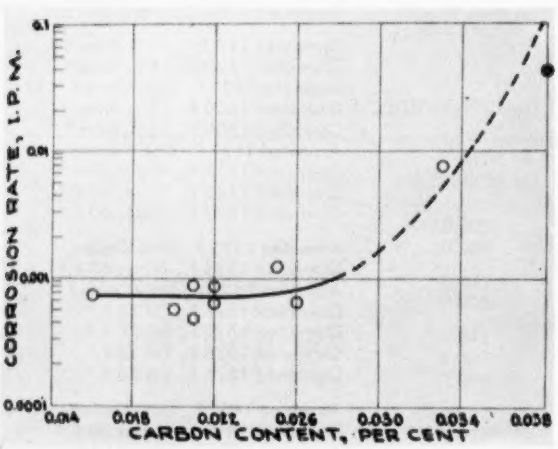


Fig. 9—Influence of carbon content on nitric acid resistance of 18-8 sensitized two hours at 1200F.

sections, was hard and had a brittle white fracture. As such it is known as white iron. It was annealed for 36 hours at 1650 F, furnace cooled to 1310 F, then cooled to 1275 F at the rate of 2 F per hour. After this anneal, it lost its brittleness because malleable iron was formed.

The second heat was melted and poured on to a nodularizing mixture in a ladle, and then into a keel block mold. This made nodular cast iron. A third heat was made and ferrosilicon was added to increase the silicon content. A keel block mold was then poured. This sample was gray cast iron. Table 3 gives the analyses and the properties of the cast irons described above.

Figure 11 shows the microstructures and properties of the irons with relation to their carbon contents. In all of them the carbon is almost entirely in the form of graphite or elemental carbon. In the gray iron, the graphite is in the form of ribbons or flakes. These tend to break up the continuity of the iron matrix. Since graphite is very weak, the ribbons or flakes act similarly to voids of the same shape. Hence these irons have very low strengths and practically no ductility. By varying the analyses and by inoculation, such irons can be made somewhat stronger than the example given, but all such variations cause changes in the size of the graphite flakes.

In white iron, the carbon is almost entirely combined with the iron to form the hard and brittle iron-carbide compound. After annealing the iron carbide has been converted into graphite clumps in a matrix of iron and hence is softer and has better ductility. It is now malleable iron. It must always be cast as white iron. Because it is necessary to chill such iron, it is not possible to make heavy sections (usually over 1 inch) in either white or malleable iron.

The next heat is nodular iron. It may be made directly from molten iron by treating it with various nodularizing agents. Well defined spheroidal graphite particles are formed in a matrix of iron which is not broken up as it is by the graphite flakes of the gray iron. The strength of this iron is many times that of the gray iron of the same analysis. Its ductility is illustrated in Fig. 12 which shows 1/8-in. rods of gray iron and nodular iron which have been bent cold. Because of its graphite content and distribution, the nodular iron machines as well as gray iron, but has properties similar to steel. Thus the properties of cast irons are largely determined by the type of carbon they contain.

Summary

Carbon increases the strength and hardness in steels, particularly after heat treatment. The ultimate possible strength and hardness is largely determined by the amount of carbon present. Tensile strengths of 50,000-350,000 psi can be obtained in steels with a carbon variation of less than one per cent. No other alloying elements gives results comparable to carbon, in such small amounts.

In cast irons the type of carbon largely determines the properties of the metal.

The very important role of carbon in ferrous metals should be considered when designing machines or structures.

TABLE 3—CHEMISTRY AND PHYSICAL PROPERTIES OF CAST IRONS

	% TOTAL CARBON	% SILICON	% MANGANESE	% SULPHUR	% PHOSPHORUS	TENSILE 1000 psi	Yield 1000 psi	ELONGATION IN 2 IN.	BRINELL HARDNESS NUMBER
Malleable	2.20	1.11	0.23	0.031	0.032	48.2	28.5	22.0	103
Nodular	3.01	4.43	0.17	0.004	0.055	90.5	82.1	10.0	217
Gray	3.05	4.39	0.17	0.019	0.052	11.4	00.0	00.0	83

Fig. 10—Photomicrograph of carbide precipitated 18-8 after exposure to corrosive agent. Magnification: 500X.

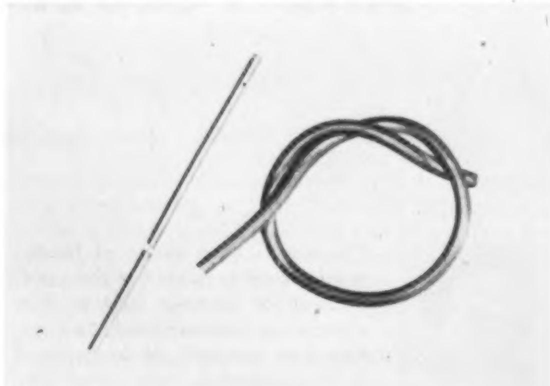


Fig. 12—⅛-in. rods of nodular and gray iron bent cold to show ductility. Nodular iron tied into knot.

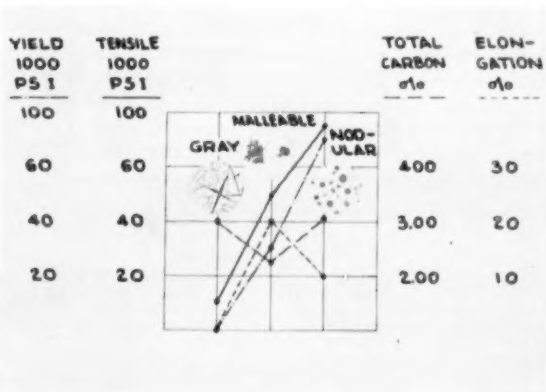


Fig. 11—Physical properties and microstructure of cast irons is shown in graph above.

The authors acknowledge the assistance of T. T. Rick and J. M. Doherty, metallurgists in the Allis-Chalmers Research Laboratories, for the melting of the experimental heats and for heat treating the experimental bars from these heats.

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Relation of Riser Range And Feeder Adequacy—Part I

WILLIAM S. PELLINI / *Head, Metal Processing, Naval Research Laboratory*

W. S. Pellini

The results of a series of fundamental studies related to the solidification of castings and to riser action are summarized and reduced to generalized concepts. It is demonstrated that metal and mold factors codetermine the general mechanism of solidification and that differences in the conditions of solidification at various positions of a given casting or riser relate only to rates of solidification; the heat transfer characteristics determined by the ratio of volume to surface area establish the specific rates at which the solidification process proceeds. Risering requirements with respect to adequacy are demonstrated to be primarily determined by the solidification time of the casting, while the requirements with respect to feeding range are shown to be determined by the geometry characteristics of the casting. Quantitative data of riser feeding distances for steel castings of various simple shapes are presented. The paper, presented at the 1953 International Foundry Congress, is being published in two parts; Part 2 will appear in December.

■ Foundrymen have considered the advancement of the "art" of risering to a science as a highly desirable goal. The probability of its ultimate accomplishment is viewed, however, with considerable skepticism. Such a pessimistic view of the complexity of the risering problem was well founded as long as the true nature of the solidification of castings remained virtually unknown. In view of advancements which have been made in the knowledge of solidification such pessimism is no longer warranted.

It is not to be implied that risering can, as of now, be based entirely on scientific principles, but that basic information is available and it is only a question of time and rate of research effort before the goal is reached. In fact, significant developments have already been made and utilized on production scale [1, 2, 3, 4, 5, 6]. These developments relate to the use of calculation methods for determining the proper size and spacing of risers for castings of moderately complex shapes. Caine[4] recently reported to the International Foundry Congress on the use of methods which he evolved for riser dimensioning and reviewed the advancements in development of scientific procedures for spacing.

It is most essential for a proper approach to risering problems that it be recognized that risers perform

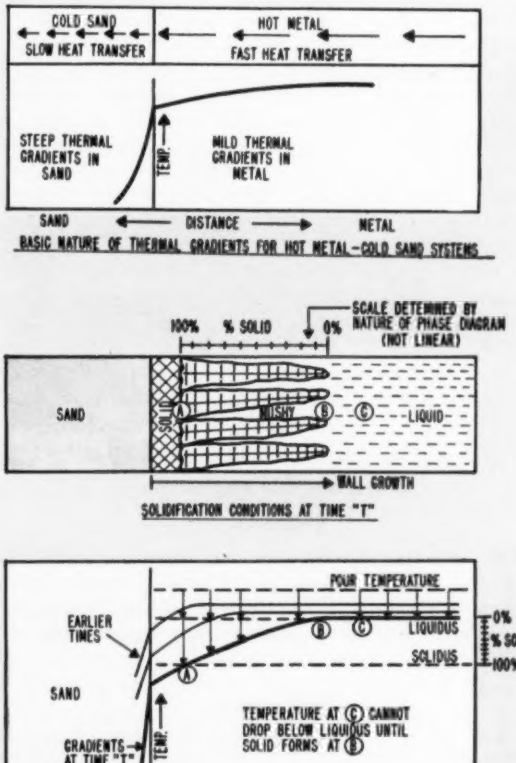

Fig. 1—Thermal and physical features of wall growth.

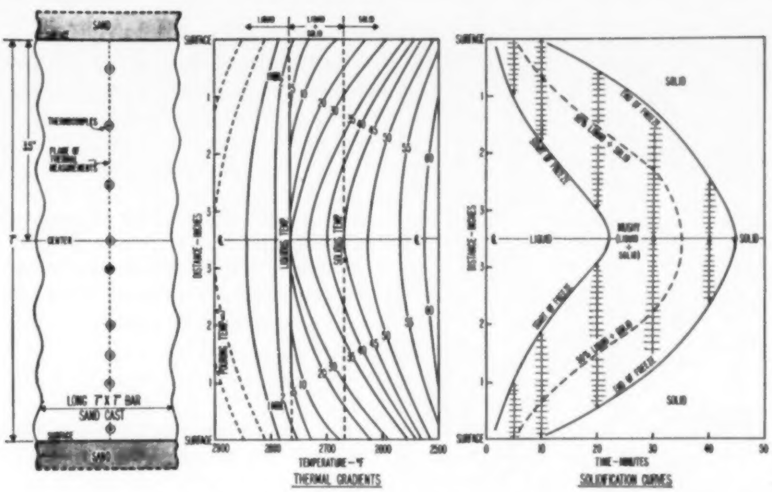

Fig. 2—Wall growth solidification curves for 0.30 per cent carbon steel, as determined by thermal analysis.

two distinct functions. Risers serve not only to furnish the liquid metal necessary to compensate for the liquid to solid shrinkage, but also in a limited degree to promote proper patterns of directional solidification. Riser size is related to the first function while riser positioning, in certain cases, is related primarily to the second. If the riser size is inadequate, gross shrinkage will extend into the casting proper (under-riser shrinkage); excessive spacing distances will result in dispersed shrinkage (centerline shrinkage). Failure to recognize the two basic functions of risers and their relation to shrinkage defects has confused the problem of risering and exaggerated its complexity.

The requirements of riser size and spacing are basically related to the conditions of solidification. It is essential, therefore, that the solidification characteristics of castings and risers be understood, i.e., the development of a broad knowledge of solidification must necessarily precede the development of truly scientific procedures for risering. The development of empirical rules for riser sufficiency and spacing does not eliminate this need, inasmuch as it is impossible to cover all types of castings by such rules. The development of rules for simple and moderately complex shapes and the determination of the condition of solidification can serve as basic guides for resolving more complex risering problems. This process is in keeping with the established method of approach to complex technological problems; i.e., development of detailed knowledge of simple cases plus basic concepts which provide a rational basis for extension to more complex cases.

It is the purpose of this paper to present an analysis of the relationship of solidification factors to risering requirements, based on newly developed information relative to solidification and feeding characteristics of various casting shapes. It is hoped that the generalized concepts which are evolved will serve to advance further the progress of scientific risering.

Solidification Factors Related to Risering

Process of Wall Growth. The solidification factors of primary importance to risering are the characteristics of the growth of a solid skin from the various mold walls of the casting and of the riser. It will be shown in the discussions to follow that the process of wall growth occurs by the same mechanism at all positions of a given casting or riser; the only differences are in the rates of growth as determined by the heat flow conditions of the various component sections. The process of wall growth differs, however, with the type of metal cast and the thermal characteristics of the mold wall. These differences are important to the problem of risering the various metals. The case of solidification of steel will be considered in detail in this report in keeping with the emphasis on the risering of steel castings. The basic concepts of riser action, however, are generally applicable with due consideration of the solidification features of the metal concerned. For a general discussion of the solidifica-

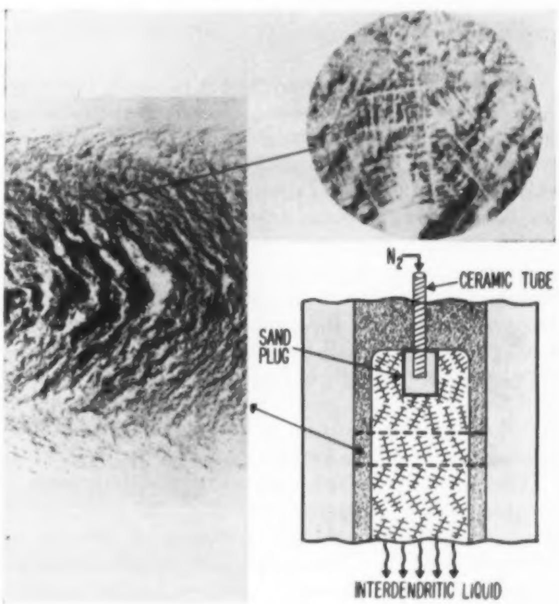

Fig. 3—Radiograph of 1/8-in. thick section cut from 20 x 7 x 7 in., 0.30 per cent carbon steel casting, pressure bled at 30 minutes. The dendrite plus liquid structures in center regions and solid skin show conformance to predictions of solidification curves in Fig. 2.

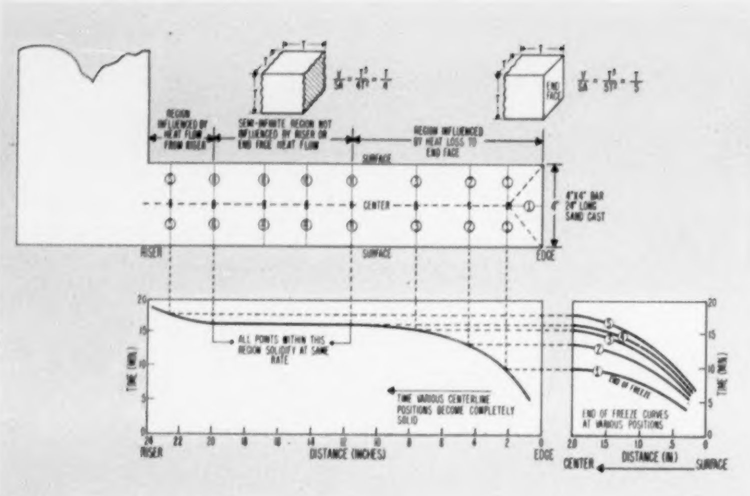

Fig. 4—Illustrating that directional solidification results from variations in rates of wall growth as determined by heat transfer conditions at various casting positions.

tion features of the various metals the reader is directed to references No. 7, 8, and 9.

The most basic aspect of the solidification process is provided by phase diagrams which relate the physical state (liquid, solid or intermixed liquid-solid phases) to temperature. These diagrams show that alloys solidify gradually over a range of temperatures. Steels of 0.25-0.30 per cent carbon, for example, start to solidify at approximately 2760 F (liquidus) and complete freezing at approximately 2680 F (solidus). At temperatures between the liquidus and solidus the metal is a mixture of both liquid and solid; the percentage of each phase at any particular temperature may be determined by application of the lever arm principle.

The constitution diagram is not in itself, however, sufficient to define the mode of wall growth during solidification. Another basic factor which must be considered is the thermal gradient conditions that exist during the solidification period. In other words, the constitution diagram defines the phase conditions which exist at any given temperature, and the distribution of temperatures in the casting at any given time defines the distribution of phases at various points in the casting. During the process of wall growth of a steel casting there will exist: (1) a completely liquid zone; (2) a mushy zone of intermixed liquid and solid; and (3) a completely solid zone. Depending on the interval of the solidification period all three zones may exist concurrently at various positions in the casting.

The process by which the nature of solidification is determined by dual consideration of the constitution diagram and temperature gradients is known as thermal analysis. The procedure entails inserting thermocouples at suitable locations in the castings to determine the thermal gradients. The thermal cycles of the thermocouples located at thermal centerpoints (last point to freeze) indicate the liquidus (hold) and solidus (inflection of the inverse rate cooling plot) points which establish the temperatures of the start and end of freezing. The thermal-time records accordingly provide the information required to deduce the solidification conditions which exist during the entire period of solidification.

Both Metal and Mold Play Part

It is important to recognize that the thermal gradient conditions which are developed within the casting during solidification are determined mutually by the thermal characteristics of the metal and of the mold. Thus, a change in the thermal characteristics of the mold material may alter the nature of solidification of a given metal, inasmuch as the temperature gradients in the casting are affected thereby. The basic laws of heat flow dictate that in a steel-sand mold system, relatively mild gradients should be developed in the steel and steep gradients in the sand. This follows from the fact that heat flow across the casting is considerably faster (high conductivity) than into the sand (low conductivity).

Figure 1 (top) illustrates the gradient conditions which should be expected by analysis of the heat transfer conditions. The figure also illustrates modifications in the thermal gradients which result from the exothermic liquid to solid phase change involved in the solidification process. While the temperature at all positions in the casting may gravitate to the level of the liquidus at relatively early time, further drop is prevented until a "wave" of initial freezing reaches the position in question. Figure 1 (bottom) illustrates schematically that a position such as *C* drops to the liquidus temperature and thereafter remains at this temperature until the contiguous position *B* begins to develop solid. Obviously, position *C* cannot drop in temperature until a gradient required for heat flow is established between *C* and *B* and such a gradient is not possible until solid begins to form at *B*.

The process of wall growth is recognized from this illustration as the gradual movement of a mushy zone (center figure) from the mold wall to the thermal center of the section; during this time the central regions of the section remain isothermal at the liquidus temperature (liquidus hold). For a given metal, the width of the mushy zone is determined by the thermal gradient conditions which result from the mutual

heat transfer relationships of the metal and mold, as described. The process of wall growth may also be represented graphically by a time-distance plot of the movement of two waves of freezing, i.e., a wave of initial freezing and a wave of final freezing, as represented by the movement of points *A* and *B* from the mold wall to the center of the section during solidification.

Wall Growth Process

Figure 2 presents detailed thermal analysis data[9] for the solidification of sand-cast commercial steel of 0.25-0.30 per cent carbon. A schematic representation of the wall growth process is provided as an aid to the interpretation of the thermal data and to the visualization of the graphical method of plotting wall growth solidification curves. The data presented are specific to the wall growth from the lateral walls of a 20 x 7 x 7-in. bar, poured at 2900 F in a green sand mold. Except for a change in the distance and time scale and for differences in rates due to casting geometry factors, the mechanism defined is characteristic of the solidification of this steel at any sand wall position of a casting or riser. In other words, solidification proceeds in the described fashion (same mechanism) but at different rates depending on factors to be discussed.

The thermal gradient conditions shown in Fig. 2 indicate that immediately following pouring, thermal gradients are established in the liquid metal which adjoins the mold wall. The gradients move inwards toward the thermal center of the casting (geometric centerline or center plane for simple castings of this type) and the superheat present in the metal is gradually removed. It is observed also that the thermal gradients through the solidifying steel are relatively mild, i.e., temperatures near the surface are only moderately lower than temperatures at the center. During most of the course of solidification the maximum differences between the center and surface temperatures does not greatly exceed the freezing range of the metal.

The relative mildness of the thermal gradients which traverse the casting result in wide regions of "mushy" solid and liquid structures, as required by the phase diagram for positions at temperatures between the liquidus and solidus level. The isothermal "hold" at the liquidus temperature is observed for portions of the casting from approximately three to 23 minutes. For example, while superheat is eliminated from the center of the casting three minutes after pouring with a resultant fall to liquidus temperatures, a further drop in temperature requires a delay of approximately 20 minutes which represents the time required for the movement of the wave of initial freezing to the center.

The progression of the initial wave of freezing to the center of the casting section is plotted as the "start of freeze" curve on the solidification diagram. After the wave of initial freezing reaches the center, the process of solidification consists of growth of the dendrite structure throughout the major portion the casting section with the rate of growth being more

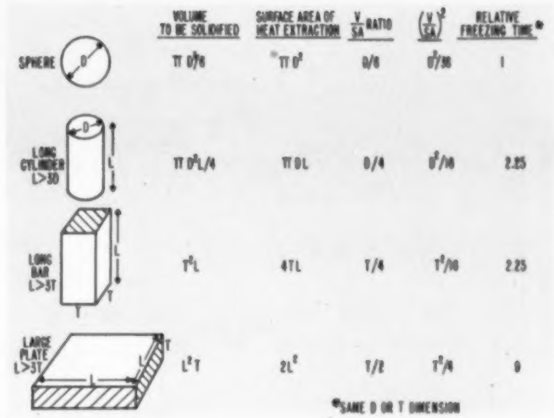

Fig. 5—Geometric V/SA relationships for various shapes.

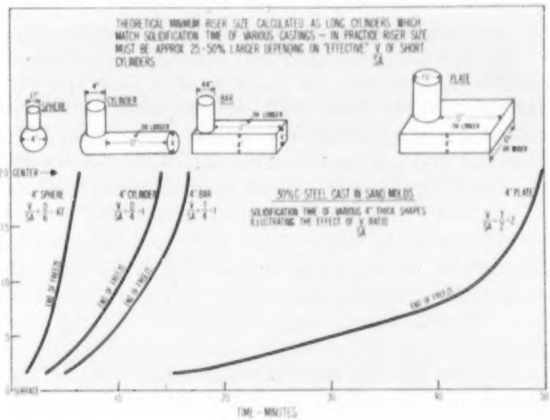

Fig. 6—Effect of V/SA ratio on solidification rates and relative risering requirements.

rapid at positions near the surface. The movement of the final wave of freezing, plotted as the "end of freeze" curve, initiates at the surface after approximately 10 minutes and is completed at the center at approximately 45 minutes, the time of final solidification of the casting. It is observed that the wall growth process is symmetrical with respect to the opposite casting surfaces. This is always the case for sections of uniform thickness irrespective of casting orientation (vertical or horizontal).

Figure 3 presents a radiograph of a 1/8-in. thick, longitudinal section from a casting which was pressure bled with nitrogen gas at the time that the solidification curves indicated a 1-in. thick, completely solid skin. The interdendritic liquid which existed at the time was expelled leaving behind an interlaced dendrite structure. Experiments of this type served to establish the validity of the solidification curves which provide the basic data of this report.

Rates of Wall Growth

Directional solidification results from variations in rates of wall growth at various casting positions. Figure 4 illustrates the nature of the directional

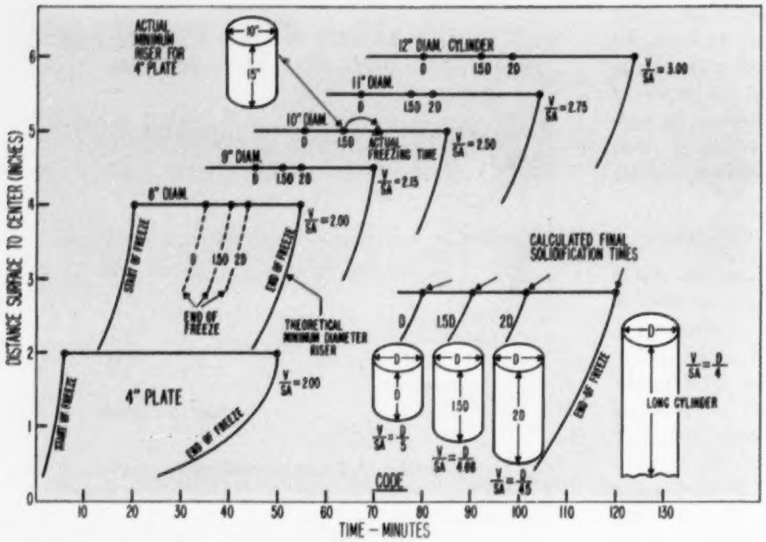

Fig. 7—Illustrating the application of V/SA concepts to the risering of a plate casting.

solidification process for the case of a long 4 x 4-in. bar, as deduced from wall growth rates at various lateral positions along the length of the bar. It is observed that positions near the end of the bar develop the most rapid rates of wall growth (curve 1) and consequently solidification to the centerline is completed relatively early. The early solidification of casting end positions must be ascribed to the relatively small ratio of casting volume to heat extracting sand area (V/SA) which characterizes the casting end. Intermediate positions which are not influenced by the casting end (or the riser) develop slower rates of wall growth and acordingly solidify completely at a later time. The term "semi-infinite" is applied to such regions to indicate that heat flow occurs only in a lateral direction (no end effects).

Wall growth therefore proceeds at equal rates at all positions within this region as is indicated by curve 4 which is common to all positions within this region. Positions near the riser solidify at a slower rate than in the semi-infinite region due to the combined effects of heat flow from the riser and slower rate of heat transfer due to the hot sand "pad" developed at the re-entrant corner of the riser-casting junction. Accordingly, the "effective" V/SA ratio of near-riser positions is greater than indicated by the geometric V/SA ratio. It will be shown in the discussions to follow that increasing the length of the bar, or any other section of uniform thickness, results only in increasing the length of the semi-infinite zone. This fact is of basic importance to risering problems from two aspects:

1. The semi-infinite zone represents a region over which solidification is not directional.

2. Solidification time is not increased by increasing the length above the minimum required to develop the semi-infinite zone (length greater than approximately three times the thickness for bars and plates assuming a riser is located at one end of the section).

The semi-infinite zone concept applies only to shapes such as bars, cylinders, plates, etc., having one or two

TABLE 1—DIMENSIONS OF VARIOUS SHAPES HAVING EQUAL V/SA RATIOS

V/SA	Sphere Diameter	Cylinder Diameter	Bar Thickness	Plate Thickness
1	6"	4"	4"	2"
2	12"	8"	8"	4"
3	18"	12"	12"	6"
4	24"	16"	16"	8"
5	30"	20"	20"	10"
Formula for V/SA Calculation	D/6	$\frac{T}{4}$	$\frac{T}{4}$	$\frac{T}{4}$

dimensions which from a thermal or solidification viewpoint may be considered infinite. For example, increasing the length of a bar above the 3T minimum required to develop a semi-infinite condition does not further affect the V/SA ratio inasmuch as the limiting V/SA ratio is developed when heat transfer occurs solely through the four side surfaces. Similarly, for the case of the plate the limiting V/SA condition is developed when heat transfer occurs solely through the two side surfaces. Obviously, for the case of cube or spherical shapes all possible dimensions are fixed geometrically and there are no semi-infinite positions; for such shapes the V/SA ratio is invariant.

Influence of Geometry

The limiting V/SA characteristics of the various geometrical shapes determine the minimum rates of wall growth and accordingly the limiting time of solidification. Figure 5 illustrates the wide variations in the geometric V/SA ratios of various shapes. The smallest ratio of volume to surface area possible is obtained with a spherical shape while the largest is obtained with a plate shape of semi-infinite (limiting) characteristics. For example, a plate of thickness T having the same surface as a sphere has a volume three times as large as the sphere. Table 1 presents the dimensions of various simple shapes having equal V/SA ratios. Thermal analysis "end of freeze" curves

for various 4-in. thick casting shapes of widely different volume to surface area ratios are presented in Fig. 6. It is observed that the ratio of volume to surface area determines the solidification time.

As indicated previously, the length of the casting affects solidification time only if the lengths are less than the maximum required to develop a semi-infinite zone. It may be deduced that as the length of the 4-in. plate shown is decreased to less than 12 inches (same width) a bar shape is approached with the result that the V/SA ratio approaches unity and the solidification time is reduced from 50 to 17 minutes (time for 4 x 4-in. bar). Decreasing the length of the 4 x 4-in. bar causes an approach to a cube shape with a V/SA ratio of 0.67 and a solidification time of approximately seven minutes.

According to Chworinov[10], the relative solidification times of castings are in relation to the squares of the geometric V/SA ratios:

$$\frac{\text{Solidification time of A}}{\text{Solidification time of B}} = \frac{(V/SA)^2 \text{ of A}}{(V/SA)^2 \text{ of B}}$$

Using this formula the relative solidification times of the shapes shown in Fig. 5 would therefore be as indicated in the last column of the figure. The validity of Chworinov's concept, as well as its significance and limitations, have been the subject of considerable contention. The data presented in Fig. 6 are representative of results which have been obtained in the course of extensive investigations of the validity of the $(V/SA)^2$ relationship. These studies have shown that the $(V/SA)^2$ relation is essentially correct for different thicknesses of the *same shape* (plate, cylinder, bar, etc.).

When a change of shape is involved (for example, calculation of the solidification time of a plate from the known solidification time of a cylindrical shape) corrections are required. Briefly, for the same geometric V/SA ratio, chunky shapes such as spheres or cubes solidify at a later time than the less chunky bar and cylindrical shapes, and these in turn solidify at a later time than the rangy plate shapes. The differences due to effects of shape per se have been established sufficiently to permit practical allowances in the V/SA calculation.

The cause of shape effects is inherent to the relative amount of specific heat which must be removed from near surface positions prior to completion of solidification at the center of the section. For a given V/SA ratio, chunky shapes present a longer surface to center distance (for example, V/SA = 2 represents a 4-in. thick plate and a 12-in. diameter sphere) than rangy shapes, hence must develop lower surface temperatures at the time that the center reaches the solidus temperature. The additional specific heat which is removed from near surface positions during the solidification interval results in a delay in the time of final solidification at the center of the section. It has been determined that variations of superheat level also cause significant deviations from the solidification times indicated by V/SA relationships. For example, plates develop a delay in the time of final solidification which approximates +25 per cent/100 F superheat while bar and cylindrical shapes develop a delay of approximately +10 per cent/100 F superheat.

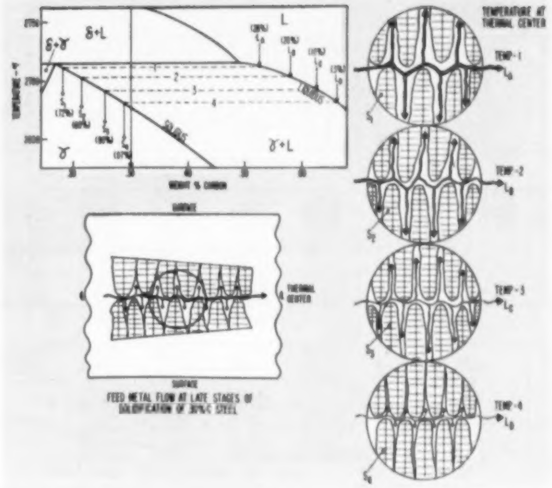

Fig. 8—Microfeatures of feed metal channels related to nature of solidification, determined by phase diagram.

It has been concluded as the result of these various investigations that at the present state of knowledge it is possible to adjust V/SA relationships to permit calculation of relative solidification times of various forms of simple and moderately complex shapes with an accuracy of approximately ± 15 per cent. Further research is required to establish correct methods of calculation for the case of complex castings which involve heat exchange between sections.

Application to Riser Dimensioning

The importance of the V/SA concept to the problem of riser dimensioning cannot be overemphasized inasmuch as the V/SA approach represents the only feasible method of developing scientific riser dimensioning procedures. The fundamental research which has been performed by mathematical, electrical analogue [11, 12], and thermal analysis methods to establish the significance of V/SA relationships should be recognized as of great practical value. Two general procedures have been adopted in the various approaches to the use of V/SA relationships:

1. Direct use of V/SA calculations on the assumption that the ratios of relative solidification times are the same as the geometric V/SA ratios.
2. Indirect use of V/SA calculations based on empirical relationships of shrinkage and soundness limits.

The direct V/SA calculation methods were based on assumptions which have either been shown to be incorrect or not yet proven to be correct. For example, several methods which have been proposed are based on the incorrect assumption that the relative solidification times are in same ratio as the V/SA ratio rather than in the ratio of $(V/SA)^2$.

Caine's method[4] based on indirect use of V/SA calculations recognized the limitations of V/SA concepts at the time of its development. According to his method, the V/SA ratio of the casting is related to

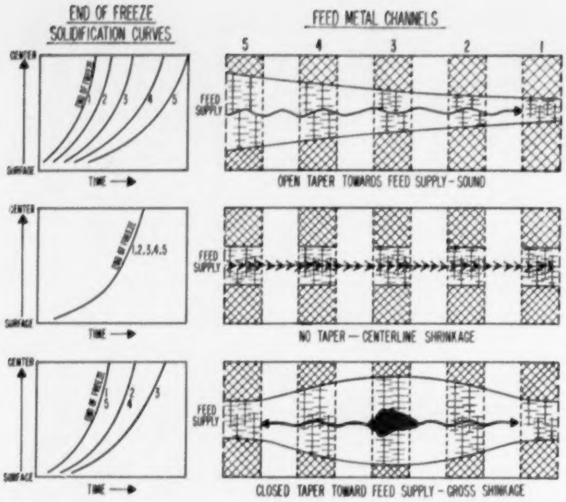

Fig. 9—Microfeatures of feed metal channels related to system of wall growth rates determined by casting geometry.

a required V/SA ratio of the riser by means of charts which indicate empirical shrinkage and soundness limits for various types of castings and methods of risering. Caine's method, while basically semi-empirical in nature, provides for a gradual transition to more direct calculation as the background knowledge is expanded by counting research.

Risers Must Be Larger

The basic feature of the V/SA calculation method as applied to risering is illustrated by the upper portion of Fig. 6. The theoretical "riser" sizes indicated for the various shapes represent the diameters of long cylinders which match the solidification times of the castings. Except for the use of strong exothermic liquidizers it would not be possible to use cylindrical risers of *less* than the indicated diameter for risering the various shapes, since the solidification time of the long cylinder is the minimum required to match the solidification time of the casting and also the maximum for the diameter in question. The diameter of practical cylindrical risers for these shapes must be approximately 25-50 per cent greater due to several factors, the effects of which have not as yet been established quantitatively. These are:

1. In practice the risers are used as short cylinders which have a numerically smaller V/SA ratio (end effects not completely eliminated) as compared to a long cylinder (V/SA = D/4).

2. Near riser positions in the casting solidify at later times than determined by geometric V/SA factors because of the heating effect of riser and of the hot spot condition created by the "L" and "T" type section formed at the point of junction of riser and casting.

3. The drop in liquid level which occurs during feeding of the casting generates a concentric ring of solid metal at the riser surface which continues to remove and dissipate heat to the surrounding sand and accordingly lowers the effective V/SA of the riser at intermediate and late stages of solidification.

In addition, it is recognized that at late stages of solidification the riser must remain sufficiently open to transport feed metal with ease. A riser which is in late stages of solidification at the same time as the casting cannot accomplish this purpose effectively inasmuch as the passage of the small amount of available feed metal is highly restricted by the narrow feed channels then available.

Figure 7 provides data of the solidification characteristics of a 4-in. thick plate as compared to various long cylinder and riser shapes. The solidification times indicated for the 1D, 1½D and 2D high risers were calculated on a basis of the geometric V/SA ratios (V/SA = D/5, D/4.66, and D/4.5 respectively, as compared to D/4 for a long cylinder) on the assumption that the heat loss rate of the top face is the same as that of the riser sides and that no heat loss occurs at the contact face. The calculations were based on the Chworinov relationship, for example:

Known: The solidification time of a long 8-in. diameter cylinder is 55 minutes (thermal analysis data).

Calculate: The solidification time of a 1½D high, 10-in. diameter riser.

$$\text{Riser: } \frac{V}{SA} = \frac{D}{4.66} = \frac{10}{4.66} = 2.14$$

$$\text{Long Cylinder: } \frac{V}{SA} = \frac{D}{4} = \frac{8}{4} = 2$$

$$\frac{\text{Sol. time Riser}}{\text{Sol. time Long } 8'' \text{ Cyl.}} = \frac{(V/SA)^2 \text{ Riser}}{(V/SA)^2 \text{ Long } 8'' \text{ Cylinder}}$$

$$\frac{\text{Sol. time Riser}}{55} = \frac{(2.14)^2}{(2)^2}$$

$$\text{Sol. time Riser} = \frac{(2)^2}{(2.14)^2\,55} = 63 \text{ minutes}$$

The calculation is simple and would yield accurate information if the riser heat loss conditions were as assumed. Obviously, the difficulty in using this method lies in the presently unknown corrections which should be applied to the geometric V/SA ratio of the riser so as to establish an "effective" V/SA ratio. Research effort at present is directed to establishing the relationship between geometric and effective V/SA ratios of various riser types when used on castings of chunky, intermediate, and rangy characteristics. It is interesting to note that 10-in. diameter 1½D high risers (see Fig. 7 relationships) are of minimum adequacy for 4-in. thick plates when used with conventional risering compound covering, indicating a near agreement with the geometric relationships.

Need More Information on Combined Shapes

The foregoing discusions have been presented to illustrate the general approach which is required for evolution of methods for the scientific proportioning of risers and also to emphasize the limitations of basic knowledge which must be surmounted to fully achieve the goal. The problem of effective V/SA ratio as contrasted to geometric V/SA ratios is also inherent to the casting. Inasmuch as complex castings actually

represent combinations of simple shapes, information is required as to the intereffects of simple shapes joined in various combinations. For example, information that **L** joints of plates sections solidify at 1.3t (t = time of flat plate) and **T** joints at 1:5t provide a means of adjusting the known time of solidification of a flat plate to that of the joint.

If the casting is composed of thick sections joined to thinner sections, it is necessary to know the effect of the thin sections on the solidification time of the heavy section which serves as the riser position. Recent work has shown that for cases of large differences in section size, the heavy section may be considered, for practical purposes, as an entirely separate body. For the case of cores having a diameter of less than one-half the section thickness, the core surface area may be discounted in the V/SA calculation; for the case of cores having a diameter greater than twice the section thickness the V/SA relation is approximately the same as that of plate of equal thickness. Sections of complex castings which exceed semi-infinite lengths are readily calculated as independent sections of V/SA ratio typical of the shape (bar, cylinder, plate).

Riser positioning does not ordinarily present a difficult problem if the casting is composed of obvious chunky sections joined to rangy sections. In such cases, the position and number of risers is determined by the distribution of the individual chunky regions. However, if the casting is of uniform or nearly uniform geometry, it is necessary to know the distance which individual risers will feed to soundness before the position and number of risers can be established. The following sections of the report present a summary of the feeding distance relationships which have been determined for single and combinations of uniform sections. The solidification and feed metal flow conditions which determine the development of soundness or of shrinkage are discussed in detail for the purpose of presenting a comprehensive analysis of the feeding problem.

Characteristics of Feed Metal Flow

The development of soundness, gross shrinkage, or centerline shrinkage in a casting is determined by the nature of the channels available for the movement of feed metal. Analysis of the characteristics of feed metal channels requires consideration of the aspects of wall growth and also of the aspects of directional solidification. As described previously, the wall growth of steel in sand molds results in the development of a mushy condition of interlaced solid and liquid. Accordingly, feed metal must flow through complex interdendritic paths (microfeatures of feed metal flow). The direction of the flow must necessarily be such as to compensate for liquid-solid shrinkage at positions of more rapid solidification, i.e., feed metal must flow from positions which solidify slowly to faster solidifying position (macrofeatures of feed metal flow).

Figure 8 illustrates the changing nature of the interlaced solid-liquid structure (microfeatures) as wall growth approaches completion at any given position. The conditions at the thermal center of the section illustrate the gradual constriction and ultimate stoppage of feed metal flow through the last available interdendritic channels. As dictated by the phase diagram, a decrease in temperature is accompanied by growth of the dendritic structures, narrowing of the liquid metal regions and concomittant changes in composition such that the composition of the dendrites approaches the average composition of the metal while the remaining liquid becomes enriched in the solute elements (C, Si, etc.).

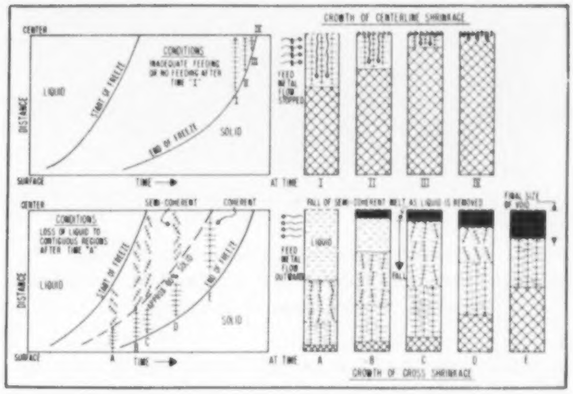

Fig. 10—Mechanism of development of centerline and gross shrinkage.

The decreased solidification temperature resulting from the segregation process is fundamentally responsible for permitting flow of feed metal to the lowest temperatures in the solidification range, i.e., to complete soundness. It is obvious that flow of liquid of composition of lower carbon content than called for by the temperature then existing, at the location in question should result in the rejection of a large quantity of solid with consequent plugging of the channel. Such effects have been noted at points of large change in section, i.e., a tendency to plug a feeding channel as higher temperature liquid is drawn rapidly into narrow feed channels.

The conditions of directional solidification determine the gross "taper" features of the channels and accordingly the direction of liquid flow. Figure 9 illustrates schematically how the wall growth solidification rates at various points in a selection establish the gross nature of the solidification channels and accordingly permit feed metal flow to soundness or prevent such flow with resulting development of shrinkage. Channels with open taper towards the main feed supply develop complete soundness, channels without taper develop centerline shrinkage, and channels with closed taper towards the main feed supply result in gross shrinkage pockets. The term *main feed supply* is used to indicate that the concepts apply to the case of large sections acting as feeders to smaller sections as well as to risers.

The mechanism by which centerline and gross shrinkage develop is indicated by Fig. 10. Parallel wall channels are capbale of feeding during most of the solidification period inasmuch as the feed metal moves inward as the result of hydrostatic and capil-

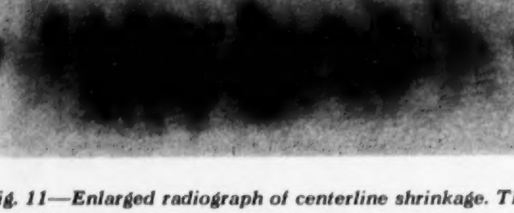

Fig. 11—Enlarged radiograph of centerline shrinkage. The dendritic structure is developed as result of inadequate feeding at final stage of solidification.

lary forces to fill the voids left by liquid-solid shrinkage. However, at the last stage of solidification the interdendritic channels become highly obstructed and passage of feed metal from the riser through long expanses of such channels is not possible. As the result, the small pools of interdendritic liquid at the centerline are drained to feed contiguous lateral regions. The drained regions along the centerline cannot be refilled and hence remain as small shrinkage pockets in a dispersed line-like arrangement. Figure 11 illustrates typical dendritic outlines of centerline shrinkage regions developed in thick sections (3 to 4-in. bar and plates); in thinner sections the size of the voids decreases and the dispersion increases.

Gross shrinkage is developed in the case of channels with closed taper towards the main feed source inasmuch as feed metal flow is cut off at relatively early stages of solidification. Therefore, the natural thermal center-spot of an isolated region must provide feed metal for most of the total solidification time. The size of the gross shrinkage cavity is determined by the amount of liquid lost by the thermal center zone prior to the time that the mushy metal becomes coherent, i.e., before a sufficiently high proportion of solid (approximately 60 per cent for steel) is developed to prevent further settling. Thereafter, further loss of

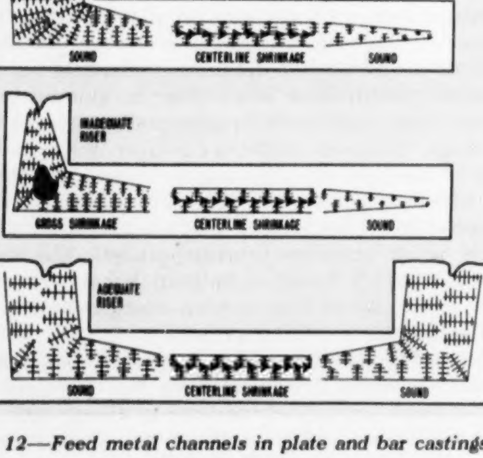

Fig. 12—Feed metal channels in plate and bar castings of uniform thickness.

feed metal occurs by out-flow from the coherent mass resulting in a general "sponginess"; however, the gross size of the cavity is not enlarged further.

This analysis also indicates that the general outline of the shrinkage pipe in risers represents the wall thickness of the solid layer plus the coherent mushy layer existing at the time that the level of liquid and associated non-coherent mushy metal fell below the various vertical positions. The lowest position of the riser pipe represents the point reached at the time the centerline of the riser developed coherency.

Figure 12 illustrates the feed metal channel conditions in bars and plates, fed by single or multiple risers, which lead to soundness or shrinkage. This simplified illustration is basic to the considerations of feeding distance conditions to be discussed.

Mr. Pellini's paper will be concluded in the December issue of *American Foundryman*.

Casting Process Shown in Color Motion Picture

A new 16-mm sound motion picture in full color is now being made available free for schools and other organizations desiring to see the story of investment castings. The film traces such castings through the "lost wax" process of antiquity, the modern production of dental and surgical appliances, to the defense output of World War II.

The film is said to be of particular interest to design and production engineers, engineering societies, and graduate groups at engineering schools. Running time is 22 minutes. The only charge is for return postage.

For inquiry, address Austenal Laboratories, Inc., 224 E. 39th St., New York, N. Y.

Foundry Accident Rate Drops

A new report by the National Safety Council shows that accident rates in the foundry industry for 1952 showed favorable decreases over the previous year. The general frequency rate within the industry decreased 14 per cent in 1952, following a 23 per cent increase in 1951. The accident severity rate also improved markedly, dropping 19 per cent in 1952, compared with an 8 per cent decrease in 1951.

These figures for the foundry industry were better than those for industry in general, which showed 1952 decreases of 7 and 9 per cent, respectively, for frequency and severity.

Room For Improvement

Although these statistics indicate a commendable improvement in foundry safety, there is still much room for work in these areas. For instance, the 1952 injury frequency rate for the industry, despite its improvement, ranked only 28th among the 40 major industry groups. This rating compares with 33rd in 1951, and 27th in 1950. The improved accident severity rate retained its 30th place ranking of 1951.

Release Tentative Program For 1954 Convention

PLANNING for the 58th annual Convention and Exhibit of American Foundrymen's Society has now reached the stage where a tentative program of technical sessions can be announced. Hans J. Heine, Acting AFS Technical Director, has released the following provisional listing, which is still subject to modification before plans are finalized for the annual meeting to be held in Cleveland's Public Auditorium, May 8-14, 1954.

Saturday, May 8, 1954

9:00 am: Registration opens
9:30 am: Exhibits open
(Northeastern Ohio Day; admission by invitation only)
5:00 pm: Registration closes
5:30 pm: Exhibits close

Sunday, May 9, 1954

No technical sessions

Monday, May 10, 1954

8:30 am: Registration opens
9:30 am: Exhibits open
10:00 am: **Technical sessions**
Light Metals
Brass and Bronze
Malleable
Noon: Light Metals Round Table Luncheon
2:00 pm: **Technical sessions**
Light Metals
Brass and Bronze
Malleable
4:00 pm: **Technical sessions**
Light Metals
Brass and Bronze Shop Course
Malleable Shop Course
5:00 pm: Registration closes
5:30 pm: Exhibits close
8:00 pm: Shop Courses
Gray Iron
Sand

Tuesday, May 11, 1954

8:30 am: Registration opens
9:30 am: Exhibits open
10:00 am: **Technical sessions**
Pattern
Light Metals
Brass and Bronze
Malleable
Time Study and Methods
Noon: Round Table Luncheons
Educational
Brass and Bronze Division
Malleable Division
2:00 pm: **Technical sessions**
Safety & Hygiene
Light Metals
Plant and Plant Equipment
Time Study and Methods
Plaster Mold
4:00 pm: **Technical sessions**
Safety & Hygiene
Brass and Bronze Shop Course
Malleable Shop Course
Educational
Pattern
5:00 pm: Registration closes
5:30 pm: Exhibits close
8:00 pm: Shop Courses
Gray Iron
Sand

Wednesday, May 12, 1954

9:00 am: Registration opens
10:00 am: **Annual Business Meeting and Charles Edgar Hoyt Annual Lecture**
Noon: Exhibits open
Noon: Round Table Luncheons
Gray Iron
Pattern
Safety & Hygiene
2:00 pm: **Technical sessions**
Sand
Heat Transfer
Refractories
5:00 pm: **Technical sessions**
Gray Iron
Sand
Safety & Hygiene
Heat Transfer
5:00 pm: Registration closes
5:30 pm: Exhibits close
7:00 pm: **Annual Banquet**

Thursday, May 13, 1954

8:30 am: Registration opens

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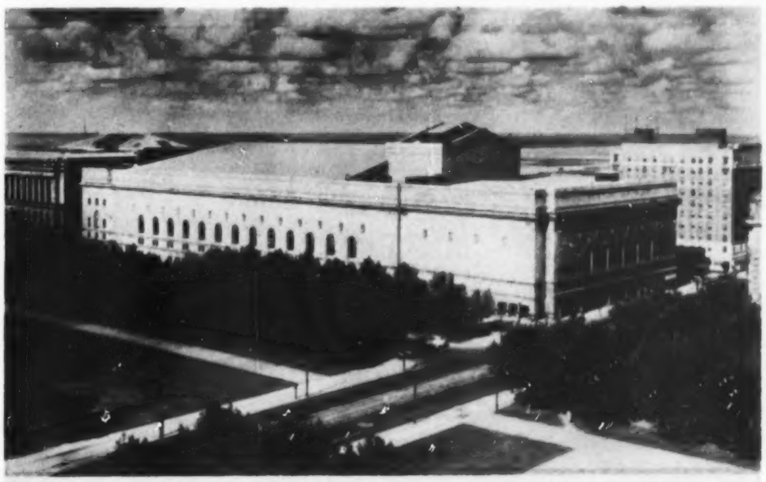


The Public Auditorium on Cleveland's Mall is the site for the 1954 Convention and Exhibit, to be staged by American Foundrymen's Society, May 8-14.

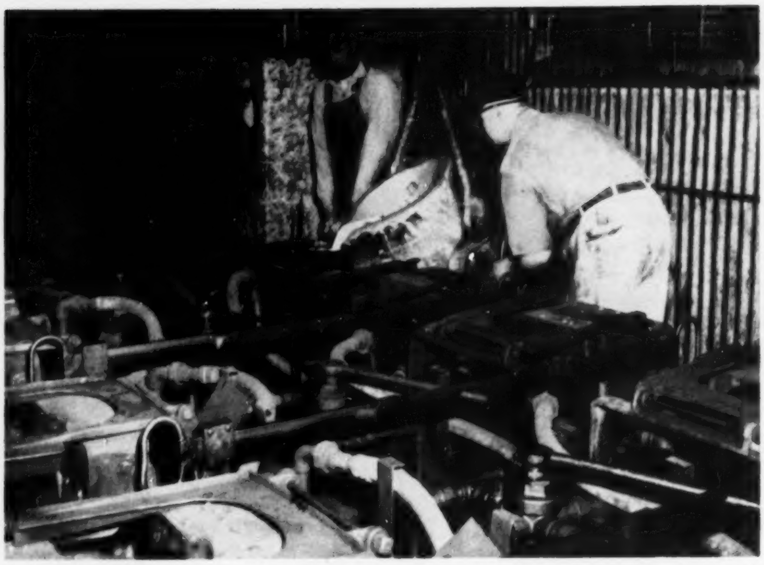
1954 Convention

continued from page 67

9:30 am: Exhibits open
10:00 am: **Technical sessions**
Steel, Gray Iron, Sand.
Noon: Steel Round Table Luncheon
2:00 p.m. **Technical sessions**
Gray Iron, Sand, Refractories, Cost.
5:00 pm. **Technical sessions**
Steel, Gray Iron, Sand.
5:00 pm: Registration closes
5:30 pm: Exhibits close
8:00 pm: Shop Courses
Gray Iron, Sand.

Friday, May 14, 1954

8:30 am: Registration opens
9:30 am: Exhibits open
10:00 am: **Technical sessions**
Steel, Gray Iron, Sand.
Noon: **Registration closes**
1:00 pm: **Exhibits close**



Grinding balls for the mills of the Homestake gold mine at Lead, S. D., are cast in banks of water-cooled permanent molds. When a mold in one bank is opened to remove the balls and gates, the mold in the other bank with which it is paired is closed automatically by an air cylinder. Balls pried out of the open molds drop into a chute leading to a tumbler. Discharged from the tumbler, the white-iron balls roll through a pipe to the ball mills where they are used to crush the gold-bearing rock.

Calendar of Future Meetings and Exhibits

November

4-6. . Steel Founders' Society
T & O Conference.

4-6. . Meehanite Research Meeting
Hotel Cleveland, Cleveland.

4-6 . . Industrial Management Society
Sheraton Hotel, Chicago. Annual Time and Motion Study and Management Clinic.

5-6 . . Pittsburgh Diffraction Conference
Mellon Institute, Pittsburgh, Pa., Annual Conference

25 . . Institute of British Foundrymen
James Watt Memorial Institute, Birmingham, England. Shell Molding.

29-Dec. 4 . . American Society Mechanical Engineers
Statler Hotel, N.Y.

December

2-4 . . American Institute of Mining and Metallurgical Engineers
Netherland Plaza Hotel, Cincinnati. Electric Furnace Steel Conference.

13-16 . . American Institute of Chemical Engineers
Hotel Jefferson, St. Louis. Annual meeting.

January 1954

22 . . Malleable Founders' Society
Hotel Cleveland, Cleveland. General meeting.

25-28 . . Plant Maintenance & Engineering Show
International Amphitheater, Chicago.

February

1-5 . . American Society for Testing Materials
Hotel Shoreham, Washington, D. C. Committee Week.

11-12. . Wisconsin Regional Foundry Conference
Schroeder Hotel, Milwaukee.

18-19. . Southeastern Regional Foundry Conference
Patten Hotel, Chattanooga, Tenn.

March

15-19. . National Association Corrosion Engineers
Kansas City Municipal Auditorium. 10th Annual Conference.

16-17 . . Steel Founders' Society of America
Edgewater Beach Hotel, Chicago. Annual Meeting.

April

5-7 . . American Institute of Mining & Metallurgical Engineers
Palmer House, Chicago. National Open Hearth Conference.

8-9 . . Malleable Founders' Society
Pittsburgh, Pa. Market Development Conference.

26-30. . American Society of Tool Engineers' Industrial Exposition
Convention Center, Philadelphia.

May

5-7. . American Society of Training Directors
Schroeder Hotel, Milwaukee. Annual Conference.

8-14 . . A.F.S. Convention & Exhibit
Public Auditorium, Cleveland.

June

14-15 . . Malleable Founders' Society
Seigniory Club, Quebec, Canada. Annual Meeting.

14-18 . . American Society for Testing Materials
Hotels Sherman and Morrison, Chicago. Annual Meeting.

Commandant F. Garrigue (second from left, far side of table), captain of the Ile de France, was host for the traveling foundry delegates. At the Commandant's left is Mrs. L. N. Shannon; second from right on near side of table is L. N. Shannon, Stockham Valves & Fittings, Birmingham, Ala., president of International Committee of Foundry Technical Associations, and AFS Past-President.

Left to right above: C. W. Williamson, Trinity Valley Iron & Steel Co., Inc., Ft. Worth, Texas; Mrs. R. W. Phelps; G. A. Euskirchen, Cincinnati Foundry Co., Cincinnati; Mrs. Euskirchen; R. W. Phelps, Otaco, Ltd., Ontario; and Mrs. Williamson. Below from left: L. D. Harkrider, General Malleable Corp., Waukesha, Wis.; Mrs. Harkrider; Mrs. Charles Hawks; Mr. Hawks, General Grinding Wheel Co.

The largest American contingent ever to attend an International Foundry Congress in Europe made the trip to Paris for the September 19-26 meeting. 200 foundrymen and their wives comprised the delegation, the largest single group of which sailed September 9 on the S.S. Ile de France. Among the 67 foundrymen on board were A.F.S. President Collins L. Carter and International President L. N. Shannon, also a Past President of A.F.S.

A special program of plant visits for the Americans during the Congress supplemented the six day technical and social events.

At the captain's dinner aboard the S.S. Ile de France are: (Left photo): From left, around table: Mrs. D. W. Stockham; Mr. Stockham, Stockham Valve & Fittings, Birmingham, Ala.; Mrs. T. H. Benners, Jr.; Mr. Benners, T. H. Benners & Co., Birmingham, Ala.; Mrs. John Wagner; Mr. Wagner, Wagner Malleable Iron Co., Decatur, Ill. (Right photo): Left to right: Mrs. Wm. W. Maloney; I. R. Wagner, Past-President of AFS, Indianapolis; Mrs. A. B. Oatman; Wm. W. Maloney, AFS Secretary-Treasurer; Mrs. Wagner; A. B. Oatman, National Carbon Div.

". . . the supervisor must realize that he is dealing with individuals whose sensitivity varies greatly."

A Simple Six-Step Technique For Better Foundry Supervision

C. H. BROADED / *Director, Management Development Institute, Mercer Island, Wash.*

The foundry supervisor who expects perfection of his employees—or himself—will be doomed to disappointment every day of his working life. Nevertheless, the mistakes which are made by your employees will have a very definite bearing on the success of your company, plant, or department; the author tells what to do about them.

▪ If employees make a relatively small number of insignificant mistakes, little damage is done. If they make a great many serious mistakes, operational efficiency is seriously impaired. A firm whose employees make few mistakes is in a very favorable position in relation to a competing firm whose employees make many mistakes.

Assuming a normally intelligent, adaptable employee, mistakes which are due to lack of information, skill, or training indicate inadequate supervision and do not call for a reprimand. The fault in such case is the supervisor's. Where the mistake results from carelessness or negligence, however, the employee is clearly at fault. In such case, the supervisor must correct the employee's attitude or continue to be plagued by careless, negligent, and mediocre performance. If the offense is ignored, the employee loses respect for his supervisor and continues to make more mistakes because he feels he can get away with it.

Technique for Reprimanding

There is a method for correcting such mistakes which is effective in the vast majority of cases. This is a step-by-step technique for reprimanding. That technique is simple and easy to remember and apply.

The method should be exercised only by the employee's immediate supervisor. Only the immediate

supervisor has a firsthand opportunity to get all the facts, and to observe the mistake when it is made. He is the only one who can determine if the mistake was actually made through carelessness or negligence.

In using this method, the supervisor must realize that he is dealing with individuals whose sensitivity varies greatly. One person may be so sensitive that his ego is hurt easily; another may be so insensitive that it is difficult to make any kind of impression on him. When reprimanding, these differences must be considered if proper results are to be achieved.

Regardless of the type of individual being censured, a properly administered reprimand using the following six-step technique, is usually effective.

1. **Cool Off (but not too long).** A supervisor's first impulse when an employee makes a serious blunder, is to become angry and "bawl him out." This tendency is aggravated if the supervisor is under a mental or physical strain caused by overwork, a succession of critical decisions, or other factors. The tendency may also be aggravated by a feeling of insecurity or inferiority on the part of the supervisor.

Though he may have many reasons for becoming angry, the supervisor should not under any circumstances permit himself the luxury of this entirely natural reaction. The employee who is "bawled out" becomes irritated, disgruntled, upset, and discouraged. He will later communicate his feelings to other workers, causing them to become upset. The entire working force can become adversely affected.

Though you should always be mentally calm when reprimanding, you should not "cool off" for too long a period. An offending employee who is not corrected within a reasonable length of time will: (1) think up a lot of excuses; (2) begin to think his boss did not know a mistake had been made; or (3) make more mistakes. In general, the shorter the interval between the mistake and the reprimand, the better.

2. **Talk to the Offender in Private.** No one likes to have his faults discussed in the presence of his fellow workers. If the mistake is corrected publicly, the offender's personal worth is lowered. He loses prestige with the group and may begin to feel insecure. Those who witness the reprimand may subject the offender to further criticism, lowering his morale further.

If the reprimand is not deserved, on the other hand, by giving it in public you may cause other employees to take the reprimanded employee's side against you. The witnesses may also feel embarrassed by the lack of tact displayed, and may develop an insecure feeling about their own jobs. Whether just or unjust nothing may be gained, and much may be lost by publicly reprimanding employees. You should therefore always talk *in privacy* with the employee whose mistake you are correcting.

3. **Make Certain that the Reprimand is Deserved.** Nothing will more quickly destroy an employee's confidence and respect for his supervisor than an undeserved reprimand. You should first determine by talking to the employee in privacy, whether or not the mistake was made through actual carelessness or negligence. After obtaining all the facts relative to the case, you should then obtain an admittance of fault from the employee. He will not accept even a deserved reprimand unless he is convinced that he was at fault. At the same time, you should find out why and how the error was committed.

4. **Show the Seriousness of the Mistake.** To make your reprimand convincing, you must yourself be fully aware of the importance in terms of dollars and cents, of preventing costly mistakes. If you are not greatly concerned about damaged equipment, spoilage, or maintenance of a quality product, neither will the employee be concerned about them. It may help in fostering the correct attitude toward costly mistakes, to keep a separate record of the cost in dollars and cents, of mistakes made by employees under your supervision.

If the mistake is serious enough to warrant a reprimand the employee should be shown the full effect of his carelessness even though the immediate damage is apparent. The subordinate should be informed of the bad results in a straightforward manner so that he will realize exactly how you feel about it. If an apparently small mistake has wide-spread consequences these should be explained fully to the employee. Otherwise he will feel that the mistake was unimportant.

5. **Encourage the Offender to do Better the Next Time.** Any normal individual will feel dissatisfied with himself upon being deservedly reprimanded. This dissatisfaction is all to the good as long as it is directed toward encouraging the employee to do a better job in the future. Again, the personal characteristics of the individual must be considered in determining the severity of the reprimand. The reprimand should not destroy the foundations of the employee's self-esteem or he will become discouraged and his enthusiasm for the job may be killed.

Since your objective is to correct the mistake and make the man a better worker, you should encourage the offender by indicating your belief in his ability. An expression of confidence in his trustworthiness implants a resolution to improve his work. An employee who knows his supervisor has confidence in him is unlikely to continue making thoughtless mistakes.

6. **Demonstrate the Right to Your Supervisory Position by Showing How to Prevent a Recurrence.** Proper execution of this step calls for exercise of your superior job knowledge acquired from previous experience and greater know-how. It may also call for exercise of some original thought to explain the technique which you understand, in terms of the employee's experience and ability. Unless this final step is carried through convincingly, your previous efforts may be wasted. By doing this you prove your worth to your subordinates and establish your right to the position you occupy.

Wherever possible, of course, the real supervisor prevents faulty workmanship by means of thorough instruction and superior job knowledge. In this way, he prevents his subordinates from making many possible mistakes. When one of them does commit one that requires reprimand, however, he exercises his ability to correct him without causing irritation or resentment, using this six-step technique to straighten him out.

Fig. 1 (Left)—Students making shell molding pattern.

Fig. 2 (Right)—Pouring aluminum alloy 108.

L. F. Mondolfo

Foundry Goes to College

▪ That foundry instruction "ain't what she used to be" is demonstrated daily in the leading engineering schools of the country. Over the years, college foundry work has developed from "sand pounding" into an engineering subject. Today, castings produced in most schools of higher learning demonstrate not only a molding method but several other principles of foundry operation. At Illinois Institute of Technology in Chicago, Prof. L. F. Mondolfo applies this method of teaching as shown in this picture story. The experiment starts with a matchplate pattern and ends with comparative properties of an aluminum alloy cast in green sand and in shell molds at a number of pouring temperatures.

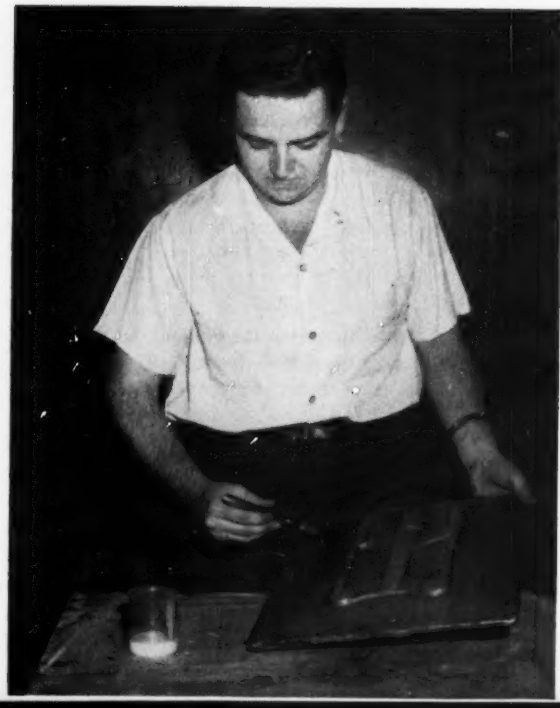


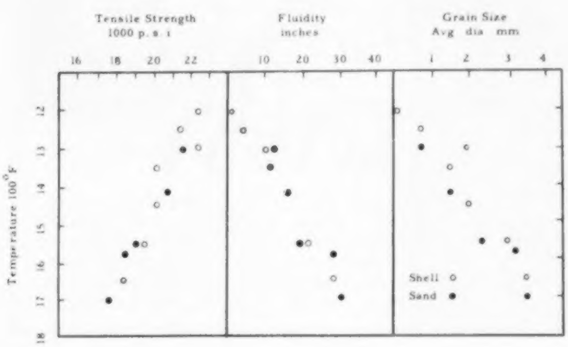
Fig. 3 (Right)—The finished metallic pattern is coated before investment.

Fig. 4 (Above)—The hot metal pattern is clamped on the investment box, which is being turned to make the mold.

Fig. 5 (Above)—Sand molds using green sand were prepared by hand molding.

Fig. 6 (Above)—Tapping alloy 108 from a gas-fired crucible furnace.

Fig. 7 (Above)—Pouring a shell mold. Fig. 8 (Left)—The results: Effect of pouring temperature on ultimate tensile strength, fluidity, and grain size of alloy 108 poured in green sand and shell molds.



CASTING through the Ages

EXACTLY **500 Years Ago** THIS YEAR, HEAVY GUNS WERE CAST FROM BRONZE FOR THE SIEGE OF CONSTANTINOPLE. TO EXPEDITE MATTERS, THESE GUNS, IT APPEARS, WERE MANUFACTURED ON THE SPOT —— VIRTUALLY UNDERNEATH THE WALLS OF THE BESIEGED CITY!

BY THE TIME HE WAS 17 YEARS OLD, **JAMES NASMYTH**— FAMED BRITISH MECHANIC OF THE EARLY 1800'S, WAS TURNING OUT MODEL STEAM ENGINES AND MAKING BRASS CASTINGS FOR THESE MODELS QUIETLY— IN HIS BEDROOM AT NIGHT— WITHOUT DISTURBING HIS SLEEPING FATHER. HE ARRANGED A FURNACE IN HIS GRATE —— RAMMED HIS PATTERNS SILENTLY IN A SECRET BOX OF MOLDING SAND —— AND CLEANED UP THE ROOM NIGHTLY SO IT SHOWED NO SIGNS OF HAVING SERVED AS A FOUNDRY! . . .

THE ITINERANT FOUNDERS OF MID-18TH CENTURY FRANCE WHO ROAMED THE COUNTRYSIDE CASTING WEIGHTS AND PLATES, BOUGHT THEIR PIG IRON FROM PEDDLERS WHO, IN TURN, PURCHASED SCRAP FROM HOUSEHOLDERS USING APPLES AS CURRENCY!

They traded -

APPLES

for scrap

ON A **POUND** FOR **POUND** BASIS.

Odd Bits

In 1654 . . .

AMERICA'S FIRST FOUNDRY—THE SAUGUS IRON WORKS OF LYNN, MASSACHUSETTS—MADE AMERICA'S FIRST FIRE ENGINE FROM BOG ORE THAT WAS DRAWN OFF, WHEN MELTED, DIRECTLY FROM THE BLAST FURNACE.

N. F. A. Holds 55th Annual Meeting in New York

THE U. S. economy seems destined for a rolling readjustment rather than a serious recession, foundrymen attending the 55th Annual Meeting of National Foundry Association in New York were told by Martin Gainsbrugh, chief economist for the National Industrial Conference Board.

Calling the recent boom one without inflation, Gainsbrugh pointed out that personal savings are at an all-time high, that the national gross product now exceeds the peak years of World War II, and that personal consumer consumption of goods and services is so strong that it could carry U.S. industry through any downward adjustments in defense spending. Nevertheless, the foundrymen were cautioned that signs of readjustment are becoming more prominent, although they do not yet foreshadow a major recession in 1954.

The President Reports

N.F.A. President Summerfield Brunk opened the two-day session on September 17 with a report to the members. He reviewed the long and useful history of the Association and its record of service to the industry. The scope of its activities in the fields, of management, labor, legislation, and similar areas was traced in detail.

Mr. Brunk announced that the entire slate of officers and members of the administrative council had been re-elected for 1953-54. Officers held over for the new term are: *President,* Summerfield Brunk, president, Headford Bros. & Hitchins Foundry Co., Waterloo, Iowa; *Vice-President,* W. W. C. Ball, vice-president, Taylor & Fenn Co., Hartford, Conn.; *Treasurer,* Frank J. Sherwin, president, Chicago Hardware Foundry Co., North Chicago, Ill. Charles T. Sheehan was reappointed as Executive Secretary for the coming year.

Continuing in office are the following members of the administrative council: Paul L. Arnold, resident manager, United States Pipe & Foundry Co., Chattanooga, Tenn.; Roger A. Black, vice-president, Ohio Brass Co., Mansfield, Ohio; Fred W. Busche, president, General Foundries Co., Milwaukee; A. Lysle Dyer, plant manager, Buckeye Foundry Co., Cincinnati; James Eastwood, president, Benjamin Eastwood Co., Paterson, N. J.; James S. Ervin, president, Mackintosh-Hemphill Co., Pittsburgh, Pa; Henry S. Faust, president, Hansell-Elcock Co., Chicago; H. M. Greenbaum, secretary-treasurer, Acme Foundry Corp., Cleveland; H. H. Harris, president, General Alloys, Inc., Boston; G. A. Kastner, personnel director, Lincoln Brass Works, Inc., Detroit; H. E. Ladwig, works manager, Foundries & Pattern Shops, Allis-Chalmers Mfg. Co., Milwaukee; Robert Langsenkamp, president, Langsenkamp-Wheeler Brass Works, Inc., Indianapolis; A. V. Martens, president, Pekin Foundry & Mfg. Co., Pekin, Ill.; William F. McQuillin, assistant to the president, Standard Buffalo Foundry, Inc., Buffalo, N. Y.; Herman Menck, vice-president, Harnischfeger Corp., Milwaukee; Frank D. O'Neil, treasurer, Western Foundry Co., Chicago; Loren Steel, assistant secretary-treasurer, Union Machine Co., Bartlesville, Okla.; R. R. Washburn, vice-president, Plainville Casting Co., Plainville, Conn.; R. D. Zangrilli, president, Standard Electric Steel Castings Co., Springfield, Mo.; and A. C. Ziebell,

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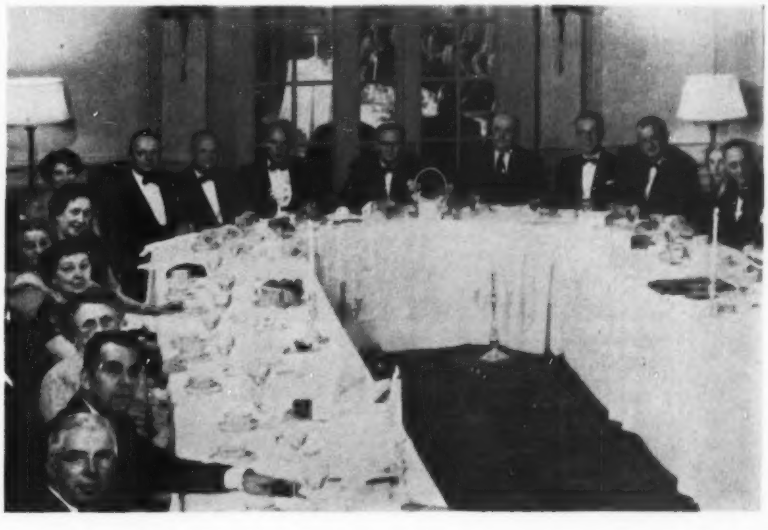


Here is part of the group that gathered for the annual Alumni Dinner of N.F.A. at New York's Plaza Hotel on September 16. At head of table is Association president Summerfield Brunk; at his right, vice-president W. W. C. Ball. U. S. Senator Alexander Wiley of Wisconsin is at Mr. Brunk's left, followed by Association treasurer Frank J. Sherwin.

Schedule Health and Safety Conference for Minneapolis

A two-day institute in foundry safety and hygiene to take place November 23 and 24 at the University of Minnesota will enable foundrymen of the area to catch up on latest health and safety techniques. Open to all, the course will be held at the Center for Continuation Study on the Minneapolis campus. Sponsors are the Twin City Chapter and the National Headquarters of AFS and the university.

Purpose of the short course is to provide an opportunity for foundrymen to meet together to learn latest developments and modern trends in safety and health protection practices in foundry operation. The program will be of interest to supervision, industrial nurses, personnel managers, and administrative and executive personnel. Covering both the large and small shop, the sessions will provide ample opportunity for discussion of problems under the leadership of authorities in the field.

On the program are nine talks, five discussion periods, and two motion pictures. Two luncheons are scheduled for the Continuation Center dining room. For the convenience of out of town visitors, housing is available in the Center.

The following program for the Foundry Safety and Hygiene Institute has been announced:

Monday, November 23

9 am: Registration and Check In

9:15 am: Introduction
J. M. Nolte, Director, Continuation Center
Presiding: Fulton Holtby, Associate Professor, Mechanical Engineering, in charge of foundry practice

9:30 am: "The AFS Safety & Hygiene & Air Pollution Program—How and Why," Wm. N. Davis, Director, AFS S & H & AP Program, Chicago

10 am: Intermission

10:15 am: "Housekeeping Hints to Eliminate Hazards," Herbert J. Weber, Chief Industrial Hygienist, American Brake Shoe Co., Chicago

11:30 am: Panel Discussion

12 noon: Luncheon, Center Dining Room

1:15 pm: "Ventilation to Control Metallic Vapors, Resin Fumes, and Fluorine Gases," Frank A. Patty, Director, Industrial Hygiene, General Motors Corp., Detroit

2:15 pm: Panel Discussion

2:30 pm: Intermission

2:45 pm: "Dealing with High Noise Levels in the Foundry," Meyer Fox, Otologist, chief of Eye, Ear, Nose & Throat Dept., Mount Sinai Hospital, Milwaukee

3:30 pm: Discussion Period

3:45 pm: Film: *"Grinding Wheel Safety,"* Norton Co.

4:15 pm: Closing Remarks

Tuesday, November 24

9:15 am: "Factors Affecting Safety Training in the Foundry," H. T. Widdowson

10:30 am: Intermission

10:45 am: "Personal Protective Equipment," Floyd Van Atta, Director, Industrial Hygiene, National Safety Council, Chicago

11:30 am: Panel Discussion

12 noon: Luncheon, Center Dining Room

1:15 pm: "Solving Personal Hygiene Problems," Dr. W. Shevick, Deere & Co., Moline, Ill.

2:15 pm: Discussion Period

2:30 pm: Intermission

2:45 pm: "Handling Foundry Materials," Lester Alexander, Minneapolis-Moline Co., Minneapolis

3:15 pm: "Handling Materials in the Foundry," Richard M. Ovestrude, Foundry Engineer, Minneapolis Moline Co., Minneapolis

3:45 pm: Film: *"Training Mechanical Material Handling Equipment Operators,"* Clark Equipment Co.

The foundry division of Eaton Mfg. Co., Vassar, Mich., was recently honored by being awarded the J. O. Eaton Safety Award for 1952, signifying the greatest improvement of its safety record over its previous five-year average. Factory Manager S. David Tyler is shown accepting a plaque from the Eaton company's safety director, Laurance S. Phillips of Cleveland. The Plant Safety Committee was also present. The award is competed for yearly among the 12 divisions of the company. The division also recently received an award in the Metals Section Safety Contest of the National Safety Council.

Buffalo Hosts Foundrymen at Niagara Frontier Regional

The first Niagara Frontier Regional Foundry Conference was held at the Hotel Statler, Buffalo, N. Y., September 17 and 18. Registration for the two-day meeting totalled 500.

Participating chapters were Eastern New York, Central New York, Rochester, Ontario, and Northwestern Pennsylvania with Western New York acting as host chapter.

General conference chairman was Grant S. Diamond, Electro Refractories & Abrasives Corp., Buffalo, N. Y., and co-chairmen were: Carl A. Harmon, Hanna Furnace Corp., Buffalo, N. Y., and Henry Sproull, A. P. Green Firebrick Co., Buffalo, N. Y. Associate conference chairmen were: John A. Feola, Crouse Hinds Co., Syracuse, N. Y.; Edwin S. Lawrence, General Electric Co., Schenectady, N. Y.; Charles F. Gottschalk, Cascade Foundry Co., Erie, Pa.; Alex Pirrie, Standard Sanitary & Dominion Radiator, Ltd., Toronto, Ont.; and Neal F. Clement, Rochester-Erie Foundry Corp., Rochester, N. Y. Joseph M. Clifford, Atlas Steel Casting Co., Buffalo, N. Y., acted as host chapter chairman.

After Mr. Clifford introduced the general chairman and officers of participating chapters, Bernard N. Ames, New York Naval Shipyard, Brooklyn, opened the conference as the speaker for a shell molding panel. Chairman for the session was Ezra Kotzin, Allegheny Ludlum Steel Co., Buffalo, N. Y., and co-chairmen were: A. J. Bzdula, General Electric Corp., Pittsfield, Mass.; A. J. Marotta, Utica Radiator Corp., Utica, N. Y.; Ray Olson, Production Foundry & Pattern Co., Chicopee, Mass.; and Dr. J. C. Searer, Durez Plastics & Chemicals, North Tonawanda, N. Y., who participated in the discussion following Mr. Ames' talk.

Discussed "C" Process

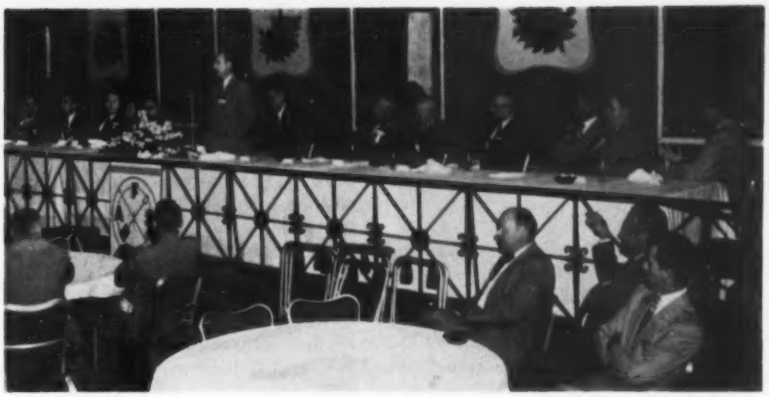
Mr. Ames, in discussing the "C" Process, pointed out that management must evaluate the use of the process for its own particular situation. Each casting must be considered on its own merits, Mr. Ames said. Shell molding doesn't replace sand in all instances, he said, but in some cases shell molding is more economical. Some industries lend themselves to shell castings, he pointed out. Parts of the automotive and agricultural industries were two of the examples he gave.

At the luncheon Henry Sproull presided. He introduced AFS National Vice-President F. J. Dost, Sterling Foundry Co., Wellington, Ohio, who greeted the conference on behalf of the national officers and directors. He traced current activities of AFS and outlined their value to the foundry industry. He also covered plans for the AFS Convention and Exhibit to be held in Cleveland May 8-14 in 1954. Mr. Dost then went on to discuss plans for the new National headquarters to be built in Des Plaines, Ill. He explained that the increased costs in labor made it necessary to increase the original estimated cost of the building from $150,000 to $250,000. This has necessitated calling for new donations from members who have not contributed as well as from members who have indicated that they would contribute additional funds if it were necessary, he stated.

Following Mr. Dost, T. E. Barlow, Eastern Clay Products, Dept., International Minerals & Chemical Corp., Chicago, spoke on *"Pressure Molding—Forming Sand Molds Under High Pressure."* High pressure molding consists of molding green sand under unusually high pressures, in many cases approximately 600 psi. Some work as low as 80 psi has been included in the same category, he said. The sand used is more nearly related to ordinary green sand then to resin or oil core sand, he

General view of speakers' table at the luncheon on September 17 in the Statler Hotel, Buffalo, N. Y. F. J. Dost, AFS Vice-President, is speaking. At his left are Conference Co-chairmen Henry Sproull and Grant S. Diamond.

C. V. Nass, Beardsley & Piper Div., Pettibone Mulliken Corp., Chicago, at the conference luncheon September 18. He spoke on "Mechanization of Core Making," using a sound movie.



pointed out. However, he said, no water is required or used. Strength is obtained by the activation of a resin coating by an organic solvent, Mr. Barlow said.

Attempts to use higher molding pressure have been made in past years, but these have been limited by the characteristics of the ordinary molding materials, he said. One of the principal limitations has been a lack of flowability, which prevented close reproduction of the pattern, even with high pressures, he stated. The molding equipment used is essentially a hydraulic-squeeze strip machine, although diaphragm squeeze is not out of the question at least at medium pressures, he declared. No jolt is needed or possible with the highly flowable sands being used, he said. The research phase of the work has reached the position from which pilot plant and semi-commercial runs can be and are being made, it was pointed out.

General Committee, Niagara Frontier Regional Conference. From left, front row: Frederick J. Goerke, chairman, Gray Iron Committee; Alex Pirrie, associate conference chairman; W. H. Oliver, chairman, Arrangements Committee; G. S. Diamond, general conference chairman; Richard Wade, chairman, Pattern Committee; J. M. Clifford, host chapter chairman; A. J. Heysel, host chapter secretary. Rear row, from left: E. J. Burke, General Program Committee chairman; L. C. Roberts, Reception and Membership chairman; J. A. Feola, associate conference chairman. On platform, in rear: T. H. Burke, chairman, Steel Committee; and Roger Walsh, co-chairman, Publicity Committee.

Influencing Properties Discussed

Following the luncheon meeting, H. H. Wilder, Vanadium Corp. of America, Detroit, spoke on *"Factors that Influence Properties of Gray Cast Iron."* Chairman for this session was Walter F. Morton, Anstice Co., Rochester, N. Y., and co-chairman was J. Douglas James, Cooper-Bessemer Corp., Grove City, Pa.

At the Thursday afternoon non-ferrous session J. S. Vanick, International Nickel Co., New York, spoke on *"Some New Aluminum Bronze Developments."* Chairman for the session was John A. Feola, Crouse-Hinds Co., Syracuse, N. Y., and co-chairmen were Robert Forrest, Lakeside Bronze, Buffalo, N. Y., and Frank D. Norwich, Whitehead Metal Products Co., Buffalo, N. Y.

In his talk, Mr. Vanick stated, that high strength manganese and aluminum bronzes disclose basic advantages in engineering properties when they are stripped of their inherited names and compared against their chemical compositions. Both develop tensile strengths up to 110,000 psi, he said. Both possess a beta phase which provides them with the foundation for their exceptional mechanical properties. Mr. Vanick stated. Manganese bronze is a 40-per-cent-zinc brass and aluminum bronze is a 10-per-cent-aluminum copper, it was pointed out. Both alloys contain booster elements such as iron, nickel, and manganese as well as aluminum, which elevate their mechanical properties and improve their engineering performance, he stated.

Corrosionwise, manganese bronze acts more like a brass and aluminum bronze acts more like copper, he said. In a common-denominator corrosive such as seawater, the copper character of aluminum bronze registers distinct advantages over the manganese bronze, Mr. Vanick pointed out. Both bronzes, he said, when properly made, endure immersion in quiescent sea water for 10 to 50-year periods without serious damage. When the sea-water is excited by rapid motion and agitation, then, he said, erosion or cavitation occurs. The resistance of manganese bronze to this form of attack, he pointed out, may be approximately doubled by suitable alloying additions.

The mechanical properties may also be moderately improved, he continued. However, he said, correspondingly alloyed aluminum bronzes multiply their initial advantage over manganese bronzes to the extent of showing ap-

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N. F. A. Holds 55th Meeting

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president, Universal Foundry Co., Oshkosh, Wis.

Stressing the high cost of the failure of understanding of instructions in business, Dr. E. M. Gherman graphically illustrated his point by presenting a projected drawing on a screen. A member of the audience was asked to explain what he had seen to one of six men who had left the room before the slide was shown. He, in turn, repeated what had been told him, and each man did the same until the version of what had been projected had gone through the entire group. By the time the sixth man had been reached, the description was hardly comprehensible to those who had seen the original slide.

Business and industry are badly in need of men who are trained in both visual and oral observation, continued Dr. Gherman. Only acute awareness of the difficulties involved in the process of communications can help alleviate a problem that annually adds a staggering toll to the cost of industrial operations.

Hear Senator Wiley

At luncheon in the Rendezvous Room of the Plaza Hotel, the members heard a speech by U.S. Senator Alexander Wiley of Wisconsin. The chairman of the Senate foreign relations committee briefly traced the development of our foreign relations policies and dwelt at length on the current world situation. Information about atomic weapons, said the senator, should be made freely available to the public, in keeping with national security. If the Kremlin knew the awful potentialities of the newer fissionable materials, it would serve as a valuable deterrent to future aggression.

Wiley defended the action of the U.S. in opposing Communist expansion in Korea. He outlined our position in voting against admission of Red China to the U.N. but warned that America could hardly withdraw from that body if the Chinese are admitted, since such an act would portend the death knell of organized efforts for world peace.

The Senator emphasized the need for international cooperation when he told the N.F.A. members that the U.S. is self-sufficient in only nine of the 38 minerals that are vital to our industry. In view of these facts, he suggested that for the U.S. to try to "go it alone is merely writing a prescription for national suicide."

"Marketing research takes the guesswork out of the background of business management decisions." That was the keynote of Frank Juraschek, of U.S. Steel Corp., who spoke on "Practical Results of Industrial Marketing Research." Mr. Juraschek cautioned the foundrymen, however, that such research cannot take the risk out of business, as long as human nature is what it is.

Lists Five Sales Points

Intelligent marketing research, he said, cannot be conducted from an ivory tower. Juraschek listed the five points of a successful sales campaign as: 1. a good product which serves a real need; 2. a definite knowledge of who needs it and can afford to buy it; 3. a sales story that fits the product to the need; 4. getting that story across to the buyer most effectively; and 5. making it easy for the buyer to buy. He used five case histories to illustrate his points.

W. J. Smale, vice-president, Michigan Mutual Liability Co., concluded the first day's program with a discussion of "Management's Responsibility Toward Safety and Air Pollution." Although the foundryman has, generally, done a good job in reducing health and accident hazards, Smale said that the inculcation of good safety habits is a necessity. He showed that the engineering of a safety program will involve different problems with each plant, and that such programs must include fulltime interest by top management, cooperation of supervisors, and coordination with the insurance carrier.

Mr. Smale referred to the safety, hygiene and air pollution program of American Foundrymen's Society. The men comprising the committee are, he said, ". . . the best qualified . . . in their field, representing all phases of safety and health." He urged all N.F.A. foundrymen to make sure of the AFS program as it applies to their plants.

Labor-Management Panel

The entire program on September 18 consisted of a panel discussion and open forum on labor-management problems. Moderator for the discussion was J. Noble Braden, of American Arbitration Assn. Representatives of management were: Paul Arnold, resident manager, United States Pipe & Foundry Co.; and Harry J. Kelley, director of industrial relations, American Seating Co. Labor was represented by Harry Southwell, president, Local 174, United Auto Workers (C.I.O.); and David Feller, assistant general counsel, United Steelworkers of America (C.I.O.).

The topics covered many phases of labor and management problems, with spirited participation by the audience. Proposed changes in the Taft-Hartley legislation were discussed at length, together with contract procedures and strike clauses. Arbitration methods were debated heatedly.

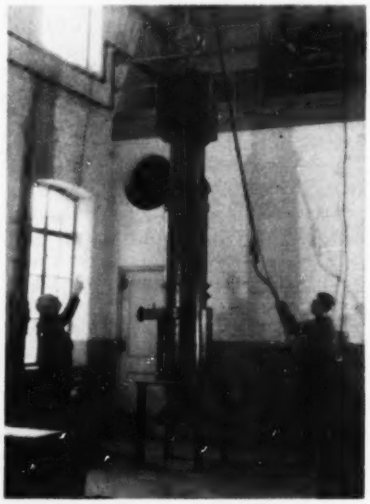
Following the mid-day luncheon, the concluding speaker of the two-day meeting was James F. Lincoln, president, Lincoln Electric Co. He based his presentation on his book, "Incentive Management," to terminate the annual N.F.A. meeting.

New Research Lab For Penn State College

A new metals processing research laboratory has been opened at Pennsylvania State College's School of Mineral Industries. Equipment has been installed for the studying of the science of molten metals and slags, with more scheduled for the future.

The laboratory is designed to train students in the use of melting and processing units and to give them first-hand information regarding iron and steel practices. The laboratory will also be used in vital research work for defense and industry.

Two-stories high, the laboratory has a five-ton, electrically operated overhead crane, and three melting units: a 2000-lb electric arc furnace, a 500-lb induction unit, and an iron cupola with a capacity of 700 lb iron per hour. Other metal working machinery is also available.



Prof. W. J. Reagan directs lowering into position of charging box during erection of iron cupola.

Five Chapters Stage Sixth Ohio Regional

Ed McFaul . . . he "wowed" them

FOUNDRYMEN from the five-chapter area of Ohio gathered at Cincinnati's Netherland Plaza Hotel on September 24-25 for the sixth Ohio Regional Foundry Conference.

Sponsored by Central Ohio, Canton, Cincinnati, Northeastern Ohio, and Toledo Chapters of American Foundrymen's Society, the Conference was under the direction of General Chairman W. L. Oberhelman, Oberhelman-Ritter Foundry Co., Cincinnati. He was assisted by the chairman of the five chapters that co-sponsored the event.

The meeting opened on the morning of September 24 with a general session in the Hall of Mirrors. B. J. Beierla, E. W. Bliss Co., Toledo, Ohio, who is chairman of the Toledo Chapter, presided over the session. He introduced Dean C. A. Joerger, College of Engineering, University of Cincinnati, who pointed out the task facing the foundry industry in overcoming past taboos in educational circles. Dean Joerger spoke warmly of the efforts of the Foundry Educational Foundation in promoting better understanding of the metals casting industry on the college level.

Use of Plastics

Principal speaker at the general session was Dr. M. F. Browne, research department, Plaskon Div., Libbey-Owens-Ford Glass Co., Toledo, Ohio. The last decade, he said, has opened the eyes of foundrymen to the tremendous potentialities of synthetic resins in casting. The four most important of the synthetic resins are 1.) the phenol formaldehydes 2.) urea resins 3.) the polyesters and alkyds; and 4.) miscellaneous phenolics.

Mr. Browne told the audience that phenolic resins are mostly used in steel foundries. They have excellent collapsibility, although a release agent must be used to overcome stickiness. The phenolics show almost negligible shrinkage, he said.

Urea resins are used for light alloys and core boxes. They have less hot strength than phenolics, but produce cores of high surface hardness and tensile strength.

The polyesters have almost twice the strength of the phenolics and are more stable. However, the speaker continued, they demonstrate more shrinkage during the curing cycle. They are useful in sealing "leaker" castings.

Among the miscellaneous resins, Dr. Browne listed epoxy, made from coal tar. This synthetic is used for patterns and fixtures; is expensive, but dimensionally stable.

Over 130 million lb of vinyl plastics were produced in the first quarter of 1953. They find application in patterns, flexible molds, and plastic mold coatings.

In conclusion, Dr. Browne said that the use of resins in high pressure molding promises to open up a new field. Experimentation should produce radical changes in the next five years.

Following a noon luncheon in the Pavillion Caprice, the foundrymen heard from Chairman E. M. Durstine, Keener Sand & Clay Co., Columbus, Ohio. He introduced F. J. Dost, Vice-President of AFS, who greeted the Conference on behalf of the national headquarters of the Society. He outlined the current activities of AFS, strongly emphasizing the need for wider member participation. Mr. Dost discussed the eight technical divisions within AFS, their publications, preparations for the 1954 Convention, and the current research projects. Through cooperative endeavor on a national scale, he said, the foundry must indeed become "a better place in which to work."

H. J. Heine, Acting Technical Director of AFS, explained the functions of the Society's Technical Department, including coordination and program planning for the annual Convention, publication of *Transactions* and other technical books, and general integration of research projects among the various committees and divisions.

Technical Sessions

The technical program was divided into four general categories: gray iron, malleable iron, steel, and non-ferrous. Simultaneous meetings were held in each of these divisions on the afternoon of September 24 and the morning of September 25.

Gray Iron: Two afternoon sessions were scheduled in this division. The first was presided over by Chairman R. A. Epps, Stoller Chemical Co., Alliance, Ohio. He introduced A. D. Barczak, Superior Foundry, Cleveland, whose subject was "Quality Control in a Gray Iron Foundry." Mr. Barczak outlined some of the problems facing the gray iron industry in reducing rejects, and described procedures that have proved effective.

The second gray iron meeting was under the direction of Chairman Alex Prentice, Stark Foundry Co., Canton, Ohio. The speaker, R. H. Zoller, Zoller Casting Co., Bettsville, Ohio, discussed "A New Era in Melting." The cupola today, he said, is essentially the cupola of 300 years ago. And the best practical approach to cost reduction is in the types of refractories used.

Mr. Zoller reported on the use of water-tempered cupolas, which, he said, have achieved almost unbelievable results, with 15 months of continuous operation without any refractory being used in the melting zone. Some of the results have been cleaner tuyeres, clean coke in drop, lower repair cost, and increased tonnage because of reduced down time.

Malleable Iron: Joseph Bailey, Dayton Malleable Iron Co., Dayton, Ohio, presided over the first afternoon session of this division. The speaker, Milton Tilley, chief metallurgist, National

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News of Technical Committees

Cupola Handbook Sub-Committee

Chairman W. R. Jaeschke, Whiting Corp., presided over a meeting of the Cupola Handbook Sub-Committee (10-K-1 d), held in Chicago on September 10. Principal item was the revision of the "Handbook of Cupola Operation," with the purpose of placing pertinent but practical information in the hands of foundrymen who are not essentially technical men.

A proposed outline for the new handbook was carefully discussed by the committee. With certain revisions, it was adopted, based upon earlier tentative work.

In keeping with the practical approach for the new revision, Chairman Jaeschke stressed the need to provide sufficient explanation of the "whys" for certain practices.

Assignments were made for detailed work on various portions of the chapters, to be discussed again in an October meeting of the committee.

Cupola Research

A meeting of the Editorial Sub-Committee of the Cupola Research Committee was held at AFS headquarters, Chicago, on August 26.

Outlines that had previously been requested where required, were submitted. Most of them were quite satisfactory. In the few cases where suggestions were made, the material was transmitted to the chairmen of the respective sub-committees.

Although some overlapping of material was apparent, the Editorial Sub-Committee believed that this condition is desirable. This question will be resolved when drafts are available.

Refractory Linings Sub-Committee

This sub-committee met at AFS Chicago headquarters on September 11. W. R. Jaeschke, Whiting Corp., was chairman of this group also. The proposed outline for the chapters on refractory linings in the new handbook were discussed.

After considerable exploration, with particular reference to the logical development of the subject matter, a chapter outline was adopted. The first section will be titled: Purpose of Refractory Lining. Operating Conditions and Requirements is the title of section II. The Installation of Refractories is the subject of section III; Types of Refractories for section IV; and the final section will be composed of composite charts of refractory properties.

It was agreed that details of manufacture of brick are not necessary for the proposed book, and that the theoretical aspects of refractories also need not be included in the new Cupola Handbook. Details of manufacture should be concise and relevant to changes in physical characteristics under different service conditions.

Existing publications and papers will be used extensively and special attention will be given to those portions of the Cupola Handbook and the Refractories Manual which are duplicated in both publications.

T. E. Barlow, Eastern Clay Prods., Chicago, agreed to revise a technical paper on gun placed linings to fit the specialized needs of the new edition of the Cupola Handbook.

Steel Division

G. W. Johnson, Vanadium Corp. of America, Chicago, was chairman of the Executive and Program and Papers Committee meeting held at the Congress Hotel, Chicago, on August 21. G. M. McMillin, General Steel Castings Co., Granite City, Ill., served as vice-chairman.

Chairman Johnson opened the meeting with the statement that the Steel Division faced the serious problem of developing more interest among the members of AFS. That papers sponsored by the Division at past Conventions were too theoretical in nature, was advanced as one factor.

Hans J. Heine, Acting Technical Director of AFS, outlined the plans for the 1954 Convention at Cleveland, listing deadlines for program papers, and other pretinent information.

The Division will schedule three technical sessions at the Convention, with two papers per session, and a Round Table luncheon. Detailed plans for the luncheon were discussed and it was agreed that no technical paper would be presented during the luncheon period.

It was suggested that one of the technical sessions be devoted to a report on the Steel Division research project. Procedure for this session was taken under advisement for later decision. A list of suggestions for Convention papers was submitted.

Following luncheon, reasons for wanting interest in steel activities were discussed. It was reported that a sum of approximately $12,000 had been made available by American Steel Foundries for research purposes at Armour Research Foundation.

The Executive and Program and Papers Committee of the Sand Division is shown at its Chicago meeting of August 17. Standing from left: H. F. Scobie, G. A. Conger, W. R. Moggridge, D. H. Booth, G. J. Grott, D. C. Ekey, E. C. Zirzow, K. J. Jacobson, and J. S. Vanick. Seated, left to right: Burdette Jones, C. E. Foster, H. J. Heine, Chairman F. S. Brewster, Vice-Chairman O. J. Myers, W. G. Parker, C. A. Sanders, C. A. Robeck, R. H. Olmsted, J. H. Lansing, L. L. Clark, and C. C. Sigerfoos.

Chapter News

Enjoying dinner at the September meeting of the Southern California Chapter are, from left to right, Hubert Chappie, National Supply Co., and chapter chairman; William C. Baude, Mechanical Foundries Div.; and J. William Mitchell, Utility Steel Foundry. Photographer was K. F. Sheckler, Calmo Engineering Co.

★873 Members To Go

American Foundryman Society membership as of September 7, 1953, is 11,127. This is an increase of 68 new members over the previous month, but still is a long way from the goal of 12,000 members by June 30, 1954, set at the Chapter Officers Conference held last May in Chicago. Fall chapter meetings are just getting under way and it is felt that with a concerted effort on the part of every member our goal of 12,000 will be reached before next June. Three new company members have been added to the rolls during the past month. They are:

COMPANY MEMBERS

Rolle Manufacturing Co., Lansdale, Pa.; George H. Gough, Asst. Gen. Mgr. (Philadelphia Chapter).

Shallway Corp., Connellsville, Ga.; William J. White, Vice-Pres. (Non-Chapter)

Wilmington Castings Co., Wilmington, Ohio; Platt Horton, Pres. (Cincinnati Chapter) Conversion from Personal.

Wisconsin Chapter

WALTER R. MATSCHULAT
Milwaukee Bronze Casting Co.

The first fall meeting of the Wisconsin Chapter was held September 11, at the Hotel Schroeder. This was a sectional meeting and was well attended considering that there was another drawing attraction in Milwaukee at the same time, the Milwaukee Braves-Brooklyn Dodger game. At the steel meeting the new "D" process was presented.

A new 1953-54 directory and program has just been published by the Wisconsin Chapter. The informative booklet contains a calendar showing the monthly meeting dates and types of meetings, the presidents message, local history, officers and directors, 1953-54, national history, National Officers and Directors, Classes of Memberships, By-Laws, 1953-54 Program and Committees for 1953-54.

Shown at the Western Michigan Chapter picnic are from left to right, W. J. Cannon, past president, Ross Shaffer, past president and George Bartlett, chapter secretary.

Texas Chapter

WILLIAM A. BEARDEN
M. A. Bell Co.

The Texas Chapter held its first meeting of the 1953-54 season at the Menger Hotel in San Antonio, Texas, Friday, September 25. It is of note that approximately 25 per cent of those present travelled from 200 to 300 miles to be present at this meeting.

Israel Smith, Western Foundry Co., Tyler, Texas, president and chairman of the Texas Chapter, made a short

Chatting after the September meeting of the Twin-City Chapter are from left to right, Herb Blosjo, Minneapolis Electric Steel Castings Co.; Art Johnson, Northern Malleable Iron Co., chapter vice-chairman, and Tom Barlow, Eastern Clay Products Div., American Chemicals & Minerals Co.

Shown inspecting some castings at the first fall meeting of the Chicago Chapter are from left to right, Jerry Eiben, Bob Doelman and Harry Gravlin, guest speaker.

kick-off speech urging complete cooperation of all chapter members in preparing for the AFS National Conference to be held in Houston in 1955. Mr. Smith introduced J. O. (Jack) Klein, Texas Foundries Inc., Lufkin, Texas, who spoke to the group concerning their part in putting over the National AFS conference in Houston in 1955 and other highlights relative to the conference.

Mr. Smith then turned the meeting over to Edward W. Wey. Dee Brass Foundry, Inc., program chairman. Mr. Wey described the program to be presented and introduced a panel of experts who were to answer questions from the floor. The Panel members were: Charles R. McGrail, Hewitt-McGrail Co., Houston, as moderator; C. E. Silver, Texas Electric Steel Casting Co., Houston and Walter Temple, Kincaid-Osburn Electric Steel Co. Inc., San Antonio, Texas to answer steel foundry questions. John Kimes, Lufkin Foundry and Machine Co., Lufkin, Texas and Harold H. Judson of Kincaid-Osburn Electric Steel Co. Inc., San Antonio, Texas to answer cast iron foundry questions; John Bird of American Brass Co., Fort Worth, Texas and Marvin W. Williams of Industrial Foundry Co. to answer non-ferrous questions, and P. B. Croom of Houston Pattern Works to answer questions involving patterns.

Northeastern Ohio

Thomas W. Gallagher
Lake City Malleable Co.

Opening the 1953-54 chapter year, the Northeastern Ohio Chapter of AFS met September 10 at the Tudor Arms Hotel, Cleveland, with more than 200 members and guests in attendance. Immediate past president Frank Cech, Cleveland Trade School, was presented a plaque by the chapter in appreciation of his fine work during his term of office last year. The presentation was made by the new chairman, Steve Kelly, Eberhard Mfg. Co., Cleveland.

Technical speaker was Karl G. Presser, assistant director, Gray Iron Research Institute, Columbus, Ohio, whose subject was *"What Quality Control Means to a Foundry Foreman."*

Ontario Chapter

C. E. Maddick
Massey-Harris Co., "M" Foundry

Monday, October 5, at the Guelph Collegiate, Guelph, Ontario, F. J. Rutherford, Refractories Engineering & Supplies Ltd., Ontario chapter vice-chairman; John Allan, Callander Foundry & Mfg. Co., Guelph, and D. B. Herbison, Massey-Harris "M" Foundry Div., Brantford, vice-chairman of the Educational Committee opened the first session of the two year foundry course being sponsored and prepared by members of the Ontario Chapter, AFS.

The following night October 6 in Toronto, Alex Pirrie, Standard Sanitary Dominion Radiator Ltd., chapter chairman and N. L. Bennett, Canadian General Electric Co., vice-chairman of the Educational Committee opened the first session of the foundry course at the Western Technical School, in Toronto.

This two year course which covers all aspects of Foundry operation and management consists of 22 lectures to be given each year. The prepared lectures will be given by the author of each lesson all of whom are men actively engaged in the foundry industry in Ontario and are considered to be fully competent in their respective fields of activity.

Retiring chairman, Henry W. Meyer, General Steel Castings Co., standing, right, presenting the gavel to Chairman Webb L. Kammerer, Midvale Mining and Mfg. Co., at the September meeting of the St. Louis District Chapter. Seated are E. R. Belton, Progressive Pattern Co., left, and W. C. May, Dow Corning Corp., right.

Chicago Chapter

Opening meeting for 1953-54 was held October 5 with a capacity crowd of foundrymen turning out to hear Harry E. Gravlin, Ford Motor Co., Dearborn, Mich., lead a discussion of *"Sand, Metal or Men?"* John A. Rassenfoss, American Steel Foundries, president of the Chicago Chapter presided and Program Chairman Robert L. Doelman, Miller & Co., acted as technical chairman.

Deming H. Lucas, perennial membership chairman for the chapter, reported that membership of the group stood at 717 on August 31. Since April, he said, the Chicago Chapter had added 51 new members and 18 transfers from other chapters.

Mr. Gravlin started his presentation by paying tribute to the practical men of the castings industry who solve the day to day problems on the production line. He cited the need for greater recognition of the operating man's know-how and for the development of production methods through "how would you do it—here's the way I would" discussion.

The Educational Committee met under the chairmanship of Prof. Roy W. Schroeder, University of Illinois, September 17 and October 1 to develop plans for next year's course. Named to select speakers were Harold G. Haines, Woodruff & Edwards, and Wm. O. McFatridge, International Harvester Co. Promotion is under W. H. Jacobsen, Western Materials Co.; E. G. Gricus, Link-Belt Co. is developing registration procedures.

Attending the September meeting of the Central Michigan Chapter, at the Kalamazoo Country Club, are from left to right, Palmer Combs, Riverside Foundry and Galvanizing Co.; Arthur T. Ruppe, Bendix Aviation Corp.; and Chapter Chairman John E. Wolf, Midwest Foundry.

N. Illinois—S. Wisconsin

Carl L. Dahlquist
Greenlee Bros. & Co.

Northern Illinois and Southern Wisconsin Chapter members started the new season with a dinner meeting at the Bel-Mar Country Club, Belvidere, Ill., September 14. Following a round of golf and a chicken dinner, members and guests listened to a talk on the Shell Mold Process by Ray Olson, Shell Process, Inc., Chicopee, Mass. His subject was, *"Shell Molding Advantages and Equipment."*

The panel of experts attending the September meeting of the Texas Chapter are from left to right, Harold Judson, K & O Electric Steel Co., and John Kimes, Lufkin Foundry & Machine Co., Cast Iron; P. B. Croom, Houston Pattern Works, Patterns; M. W. Williams, Industrial Foundry Co., Non-Ferrous; C. H. McGrail, Hewitt-McGrail Co., Moderator; John Bird, American Brass Co., Non-Ferrous; Walter Temple, K & O Electric Steel Co., and C. E. Silver, Texas Electric Steel Casting Co., Steel.

Canton District

R. R. Kozinski
Canton Malleable Iron Co.

The Canton District Chapter held its first meeting of the current 1953-1954 program year at the Mergus Restaurant, Canton, Ohio Thursday, October 1st. Present at this meeting were 88 members and guests.

Chester V. Nass, Vice-President, Pettibone Mulliken Corp. and general manager of the Beardsley & Piper Div., was the guest speaker. His subject was, *"Mechanization in Core Making."*

Chapter Chairman, Robert A. Epps, Stoller Chemical Co., presided and presented awards to Anton Dorfmueller, Jr., Thiem Products Co., membership chairman, and Alexander Prentice, Stark Foundry Co. past chairman, for outstanding service during the 1952-1953 program year. Alfred S. Morgan, Babcock & Wilcox Co. introduced the evening's speaker.

Tri-State Chapter

Edward W. O'Brien
Oklahoma Steel Casting Co.

Tulsa played host at the opening meeting of the Tri-State Chapter, held
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Shown admiring the plane used by Ottawa-Silica Co., are from left to right, H. C. Thornton, vice-president and treasurer of the firm, and James C. Lockwood and Wayne B. Gyger, also with Ottawa-Silica.

Foundry Tradenews

National Research Corp., has announced the development of a method for the production of cast shapes of titanium metal. The accomplishment is a result of an intensive program aimed at the development of special vacuum melting furnaces, casting procedures and mold materials capable of withstanding attack by molten titanium. It is now possible to produce pilot quantities of cast shapes of both pure and alloyed titanium, it is reported. Castings of complex shape weighing up to several pounds have been made. Carbon, oxygen, and nitrogen content are reasonably comparable with commercial wrought titanium. The surface attainable is equal to that of good sandcast metals, it was pointed out.

Plaskon Div. of Libbey-Owens-Ford Glass Co., has become part of the **Barrett Div., Allied Chemical & Dye Corp.** Headquarters continue to be in Toledo, Ohio. The division recently offered to the foundry industry royalty-free licenses to use its plastic resins as sand binders.

Arthur D. Little Inc., industrial research and engineering firm of Cambridge, Mass., will open a new midwest liaison office in Chicago. The new branch will be located in the Board of Trade Building.

International Nickel Company of Canada, Ltd., is undertaking the production of by-product iron ore from nickel ores in the Sudbury District of Ontario, where its mining operations are centered. The company is beginning immediately the construction of a $16,000,000 plant in the Copper Cliff area as the first unit in an operation which will ultimately yield about 1,000,000 tons of high-grade iron ore a year, in addition to nickel, from Sudbury ores.

Aluminum Alloys Co., Inc., has opened its new permanent mold casting plant. The plant is located at 2112 W. Rice St., Chicago.

Ottawa-Silica Co., Ottawa, Ill., has purchased a Cessna 180 model, four-passenger, all metal monoplane. The ship will be used for sales activity, trouble shooting in the field, quick pickup of light equipment parts and experimental and research work. The plane cruises in excess of 150 mph and is equipped for instrument flight.

Alten Foundry & Machine Works, Inc., Lancaster, Ohio, recently staged a sales training conference designed to better fit company representatives to discuss foundry problems and the company's ability to fill customer needs. The three-day course consisted of discussions of patterns, cupola, foundry metallurgy, sands, and machines which were developed by Alten's Kenneth McGrath, manager of contract sales.

Ipsen Industries, Inc., Rockford, Ill., manufacturers of automatic heat treating equipment, is opening a new sales and service division in Plainfield, N. J. This branch office, located at 146 E. Front St., is the new headquarters of Alfred E. Stone, sales engineer.

Pekay Machine & Engineering Co. has consolidated all engineering, design and sales service functions in its main offices at 864 N. Sangamon St., Chicago. The company is closing its branch office in Detroit and personnel from there are being transferred to the expanded quarters in Chicago.

Lunkenheimer Co. Cincinnati, Ohio, is modernizing and expanding its facilities for producing steel and iron valves. The decision was made due to the growing demand for steel valves in the power, atomic energy, petroleum, chemical and other important industries.

Palmer-Shile Co., 16043 Fullerton, Detroit, manufacturers of materials handling equipment, has announced an additional 15,000 sq ft of manufacturing capacity known as plant No. 4. This is the third expansion in the past three years. The purchase of new equipment to handle the increase in production was also announced.

National Research Corp., Cambridge, Mass., has developed a method for the production of Titanium alloy castings shown above. These are produced in a vacuum arc furnace. A special mold material has been developed which withstands attack by molten titanium.

Niagara Frontier Regional

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proximately six times the resistance to erosion that is obtained for propeller-type manganese bronze.

At the Thursday afternoon session on pattern practice, A. F. Pfeiffer, Allis-Chalmers Mfg. Co., Milwaukee, spoke on *"Coordinative Function of Pattern Equipment and Castings."* Chairman for the session was Harold Brakeman, City Pattern Works, Syracuse, N. Y.; T. J. McLeer, General Electric Co., Schenectady, N. Y., was co-chairman.

Pfeiffer Used Slides

Mr. Pfeiffer, by the use of slides, pointed out that it was sometimes necessary to build a complete model to develop the most efficient design and method of production. He cited the advantage of keeping a complete running record of any of the defects that appear in a casting at the early stages and having these records follow the casting through to the completion of the casting. Mr. Pfeiffer pointed out the advantages of apprentice training and also the advantage of including everyone concerned, from the time blueprints are drawn to the completion of the casting, in discussions and the progress of each particular job.

At the steel session, T. N. Armstrong, International Nickel Co., New York spoke on *"Factors Affecting the Quality of Cast Steel."* T. H. Burke, Worthington Corp., Buffalo, N. Y., was chairman and co-chairman was R. A. Erskine, National Erie Corp., Erie, Pa.

Mr. Armstrong pointed out that the percentage of alloy steel castings produced annually averages about 25 per cent of the total steel casting tonnage produced. This is a much higher ratio of alloy steel to carbon steel than is produced by the steel industry as a whole as wrought alloy steel usually runs from six to nine per cent of the total ingot tonnage.

Must Apply Quality Control

The speaker said that because more exacting requirements are being specified for alloy steel castings to meet specific service conditions, quality control must be applied to meet these requirements.

Mechanical properties are affected by deoxidation additions such as aluminum, calcium, selenium and the rare earths, Mr. Armstrong said. He discussed the effects of each of these additions and reviewed the practices that give best results. Other factors such as density, hardenability and alloy combinations for maximum efficiency were also dealt with, as well as the problem arising from sulphur in steel and the means being used to overcome it.

Gordon Farnham, International Nickel Co. of Canada, and Benton Dixon, Dominion Wheel & Foundries, Toronto, Ont., were the speakers at the gray iron session. Their subject was, *"Recent Developments and Practical Applications of Ductile Iron."* Chairman for the session was Alex Pirrie, Standard Sanitary & Dominion Radiator, Ltd., Toronto, and F. W. Kellam, Electro Metallurgical Co. of Canada, Ltd., Welland, Ontario, was co-chairman.

Effect of Composition Discussed

The effect of composition on the properties of the ductile iron was discussed by Dr. Farnham, and particular reference was made to the influence of subversive elements. He reviewed the heat treatment of the product including the normal annealing, quench and draw, induction hardening and flame hardening treatment. Dr. Farnham also discussed wear properties, machinability and heat resistance of iron as well as the welding of ductile iron.

Mr. Dixon discussed some of the production problems encountered. He stated that his experience indicated that it is important for the men in the foundry to be familiar with the production of alloy irons, and have some experience with inoculation, if spheroidal graphite irons are to be produced with the best physical properties.

H. F. Taylor, Massachusetts Institute of Technology, Cambridge, Mass., spoke on *"Non-Ferrous Castings"* at the non-ferrous session. Chairman for the session was E. S. Lawrence, General Electric Co., Schenectady, N. Y., and W. G. Brayer, Bausch & Lomb Optical Co., Rochester, N. Y., and David Stein, Samuel Greenfield Co., Buffalo, N. Y., were co-chairmen.

Professor Taylor discussed some fundamental aspects of factors leading to unsound nonferrous castings, and dwelt on a recent British development which permits the measurement of absorbed gases in a casting by means of a partial vacuum. He also mentioned the fundamentals of freezing and discussed the fact that alloys having a long freezing range will tend to be more porous than those which pass through the mushy stage rather quickly.

At the second pattern practice session, J. M. Kreiner, National Malleable & Steel Castings Co., Cleveland, spoke on *"Patterns for Malleable and Steel Foundries."* Richard Wade, Wade & Horrocks, Buffalo, N. Y., was chairman and co-chairman was DeForest Smith, Pattern Makers, Inc., Syracuse, N. Y.

Mr. Kreiner discussed the design, construction and complete standardization of pattern and corebox equipment for modern, high production foundry use. He went on to list some of the advantages obtained by establishing the practice of providing complete construction drawings, including shrinkage allowance, of patterns and coreboxes.

C. B. Jenni Speaker

C. B. Jenni, General Steel Castings Co., Eddystone, Pa., spoke on *"Sand Reclamation in the Steel Foundry"* at the second session. W. Weir, Dominion Foundries & Steel, Ltd., Hamilton, Ont., was chairman and co-chairman was L. M. Townley, Adirondack Foundries & Steel Co., Watervliet, N. Y.

Used sands can be reconditioned or reclaimed so that they possess the properties of new sands, Mr. Jenni said. Factors, he said, which must be assessed in order to determine whether or not sand reclamation is desirable include:

1. Cost of new sand, including freight.

2. Amount of new sand purchased and consequently the amount of used sand discarded.

3. Cost of the reclamation including operating costs and amortization and depreciation of equipment.

4. Cost of disposal of used sand-facilities available.

5. Quality of the reclaimed product.

Guest speaker at the banquet Thursday evening was Ralph L. Lee, Birmingham, Mich. His subject was *"Foundry People as They Come and Are."* Mr. Lee pointed out that there has never been a time like today in the industry, when so many facts of the trade are discussed so freely. Mr. Diamond presided.

Otto V. Guenther, Erie County Technical Institute, was the speaker at the Educational Session Friday morning. His subject was *"The Role of the Technician in the Foundry and How the Foundry can Assist His training."* Chairman for the session was A. A. Diebold, Atlas Steel Castings Co., Buffalo, N. Y.; E. M. Strick, Erie Malleable Iron Co., Erie, Pa., was co-chairman.

Prof. Guenther pointed out that foundry practice is becoming more mechanized and scientific and to keep abreast of the times, management must look to trained foundry engineers and technicians. In order to prepare young

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Chapter News

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September 18 in the Blue Room of the Alvin Hotel.

Some 70 members and guests were much impressed with an excellent straight off-the-shoulder presentation on *"Safety and Accident Prevention"* by F. H. Kobely, Columbia-Geneva Steel Div., U. S. Steel Corp.

Special guests at this meeting were: P. Grymes, safety superintendent, Fidelity & Guaranty Co. of Oklahoma City, and J. H. Savage, safety director, Oklahoma City office of Mid-Continent Petroleum Corp.

Western Michigan

WILSON W. HICKS
Sealed Power Corp.

The Western Michigan Chapter held their 13th annual stag picnic at the Pontaluna Golf Club in August. Under the direction of F. J. DeHudy, Centrifugal Foundry Co., Muskegon, Mich., chairman; and J. A. Van Haver, Sealed Power Corp., Muskegon, Mich., vice-chairman. Among the day's activities were golf, baseball and horseshoes.

Corn Belt Chapter

VERN HOLMES
Paxton-Mitchell Co.

A group of safety-minded foundrymen met with F. H. Kobley, September 11. The meeting, with the manager of safety and training of the Columbia-Geneva Steel Div. of the U.S. Steel Corp., was held at the Rome Hotel, Omaha, Neb. His subject, *"Safety Through Objective Analysis."*

Northwestern Pennsylvania

ROY A. LODER
Erie Malleable Iron Co.

The Northwestern Pennsylvania Chapter of AFS opened its 1953-54 season September 28, with a dinner at the Erie Moose Club.

Charles Gottschalk, Cascade Foundry Co., chairman, gave a short resume of the planned activities for the coming year and introduced Robert Johnson, Bucyrus-Erie Co., who outlined the course in *"Grey Iron Metallurgy and Cupola Operations"* which is to begin September 29 in Academy High School under the direction of the

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Seated at the speakers table at the September meeting of the Texas Chapter are from left to right, Harold Judson, past National Director of AFS, F. M. Whittlinger, P. B. Croom, director ex-officio, Texas Chapter; J. O. Klein, AFS National Director; Israel Smith, Chairman, Texas Chapter; Edward W. Wey, Vice-Chairman, Texas Chapter; C. H. Winterborne, Chairman, San Antonio Section, Texas Chapter; and Edward W. Pruske, Secretary, San Antonio Section, Texas Chapter.

Past presidents honored at the September meeting of the Twin-City Chapter are from left to right, E. C. Madson, Anderson Corp.; R. M. Aker, Western Alloyed Steel Castings C. H. Anderson, Crown Iron Works; R. C. Wood, Electric Steel Castings; H. M. Patton, American Hoist & Derrick Co.; S. P. Pufahl, Commotator Co., and C. C. Hitchcock, R. C. Hitchcock & Sons.

Attending the September meeting of the Tri-State Chapter at the Alvin Hotel, Tulsa, are from left to right: Jackson A. Dean, Nemco Foundry, Tulsa; Don W. McArthur, Oklahoma Steel Castings Co., Tulsa; F. H. Kobley, Colombia-Geneva Steel Div., U. S. Steel Corp., San Francisco, speaker of the evening, and William D. Harris, Midwest Foundry Supply Co., Tulsa.

Abstracts

Abstracts below have been prepared by Research Information Service of The John Crerar Library, 86 East Randolph Street, Chicago 1, Ill. For photoduplication of any of the complete articles briefed below, write to Photoduplication Service at the above address, identifying articles fully, and enclosing check for prepayment. Each article of ten pages or fraction thereof is $1.40, including postage. Articles over ten pages are an additional $1.40 for each ten pages. A substantial saving is offered by purchase of coupons in advance. For a brochure describing Crerar's library research service, write to Research Information Service.

■ **A316..**"**Properties and Uses of Die Castings in the Low Melting Alloys," W. W. Richmond, *Precision Metal Molding*, vol. 11, no. 9, September 1953, pp. 58-59, 101-103.**

Die casting of lead, tin, and their alloys is similar to that of other nonferrous metals. Die cost is same as for other metals but die life is unlimited as far as heat and abrasion are concerned. Advantages of these alloys is chemical stability, accurately controlled softness, and low melting point. Disadvantages are difficulty in handling after casting, low strength, low heat resistance, low abrasion resistance, and generally low mechanical properties.

■ **A317..**"**Special Fixtures Save Labor in Polishing Die Cast Window Frames," *Precision Metal Molding*, vol. 11, no. 9, September 1953, pp. 73-74.**

Special fixtures speed polishing required prior to plating zinc alloy passenger car window frame components.

■ **A318..**"**Plastic Patterns Offer Advantages in Investment Casting," Roland S. Banister, *Foundry*, vol. 81, no. 9, September 1953, pp. 120-123.**

Plastic patterns for investment casting cost less than wax, give smoother, stronger joints, decreasing number of patterns lost during coating and investing, and are smooth and dimensionally accurate. Author gets best results with crystal polystyrene, clear or colored with analine dye. Oven conditions established for wax burnout are not suitable for plastic.

■ **A319..**"**Drops Cupola Bottom Once a Week," Edwin Bremer, *Foundry*, vol. 81, no. 9, September 1953, pp. 124-125, 298, 300, 301.**

Water-cooled, basic-lined cupola has conical bottom through which both metal and slag discharge into teapot-spout receiving ladle. Thin lining in the windbox section and baffles raise blast temperature to about 350 F. Iron temperatures about 100 F higher than with conventional cupolas are reported.

■ **A320..**"**Three Inserts Do Three Jobs in a Flywheel Magneto," S. R. Ellingham and A. I. Alstrom, *Precision Metal Molding*, vol. 11, no. 9, September 1953, pp. 56-57.**

Aluminum alloy flywheel magneto is die cast with permanent magnet, counterweight, and hub as inserts. Hub is either round and knurled or hexagonal; choice is often arbitrary though the hexagonal hub seems to give better anchorage against torsional slippage.

■ **A321..**"**Use of Self-Developing Camera to Set Coremaking Standards," Frank C. Adams and Robert S. Foerster, *American Foundryman*, vol. 24, no. 3, September 1953, pp. 46-47.**

Need for time study engineers to make rough sketches of cores in setting standards is eliminated when a camera is used. Reproductions are accurate and more complete. Core is photographed against white background so dimensions and notations can be made directly on photo.

■ **A322..**"**Let's Look at High-Pressure Molding," R. W. Heine and T. E. Barlow, *American Foundryman*, vol. 24, no. 3, September 1953, pp. 54-56.**

Molding at squeeze pressures as high as 600 psi eliminates flowability as a molding sand problem and gives extremely precise molds and castings. Preferred sand has AFS fineness of 90 with four-screen distribution and adequate fines. Special resin binders related to the original "waterless sand" binders are used. No moisture is used. Sand can be shaken out and re-used. Green sand cores are feasible because of the high green strength of the squeezed molds.

■ **A323..**"**Precision Casting with Green Sand," *American Foundryman*, vol. 24, no. 3, September 1953, pp. 34-38.**

Gray iron castings ranging from ½ oz to 50 lb made in natural and semi-synthetic sands and are expected to fit up without machining to tolerances as close as 0.008 in. Three different grades of sand are blended in varying proportions to meet three surface finish standards.

■ **A324..**"**Sandslinger Applications," Martin F. Putz, *American Foundryman*, vol. 24, no. 3, September 1953, pp. 39-44.**

Equipment for producing molds by slinging has been developed over a number of years to provide the foundryman with units that can be operated by hand or remote control, are stationary or mobile, and can be used in jobbing or production operations. In combination with other molding equipment, slingers give a high degree of flexibility and high production. They can be incorporated in fully-automatic molding set-ups.

Approximately 150 Detroit area foundrymen attended a three-day sand school conducted by Frank S. Brewster (right) of the Harry W. Dietert Co., Detroit. The sessions were held at the Woodward Avenue offices of the Detroit Engineering Society on August 10-12.

Book Reviews

Engineering Statistics and Quality Control . . . by Irving W. Burr. 442 pp., 72 fig., 67 tables. Published by McGraw-Hill Book Co, 330 West 42d St., New York 36, N. Y. $7.00 (1953).

Balanced treatment of subject presents both practical and theoretical side of statistics and quality control. Primary emphasis is upon statistics used directly by industry; methods presented are applicable to engineering research. Book was written for junior, senior, and graduate students and contains many illustrative examples, problems, and derivations.

Analysis of Aluminum Alloys . . . by G. H. Osborn and W. Stross. 144 pp. Published under auspices of Association of Light Alloy Refiners by Chemical Publishing Co., Inc.. 212 Fifth Ave., New York 10, N. Y. $3.50 (1953).

Survey of analytical methods, some new, some modified versions of known methods. Every method has been thoroughly tested by extensive application in industrial laboratories. Theory supplements details of procedure where necessary. Given are gravimetric, volumetric, electrolytic, photometric, and polarographic methods for the common elements such as copper, magnesium, silicon, iron, manganese, nickel, zinc, tin, antimony and chromium. Methods for less common elements such as beryllium, bismuth, calcium, silver, and sodium are also described.

***Metallkunde* . . . by Prof. Dr.-Ing. Habil. Heinz Borchers, 2 vols., vol. 1 —110 pp., vol. 2—154 pp., illustrated. Published by Walter de Guyter & Co., Berlin, Germany (1952).**

Two pocket-size books on metallurgy cover the subject concisely yet explicitly and comprehensively and are a handy reference on the constitution of metals and alloys, as well as their properties and fabrication.

The first booklet briefly covers fundamentals concerning the periodic system, as well as crystallography and lattice structure. Then binary and ternary systems are exhaustively discussed and typical examples of technically important systems illustrated in considerable detail. The treatment follows the generally accepted procedure and adds nothing new to the available literature.

The second booklet covers typical properties of metals and alloys, as well as their dependence upon pressure and temperature. Inasmuch as the book is a German publication, reference is made to the D.I.N. Standards. Melting and casting, as well as sintering and metal spraying are covered for the principal materials. Typical photomicrographs show representative structures, and the more commonly encountered defects are elucidated.

The usual phases of thermal treatment (annealing, normalizing, tempering, etc.) are described, and currently held theories on the phenomena encountered explained. Surface treatment is briefly stressed, and the fundamentals of welding and soldering are included.

Cast Bronze . . . by Harold J. Raost. 458 pp., 87 fig., 41 tables. Published by American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. $4.00 (1953).

Book is based primarily on the author's 40 years of experience in the field of bronze founding. Operational details of bronze foundry practice are covered in general only except in the case of statuary bronze. Style and material covered are designed to appeal to capitalist, executive, purchaser, teacher, and historian.

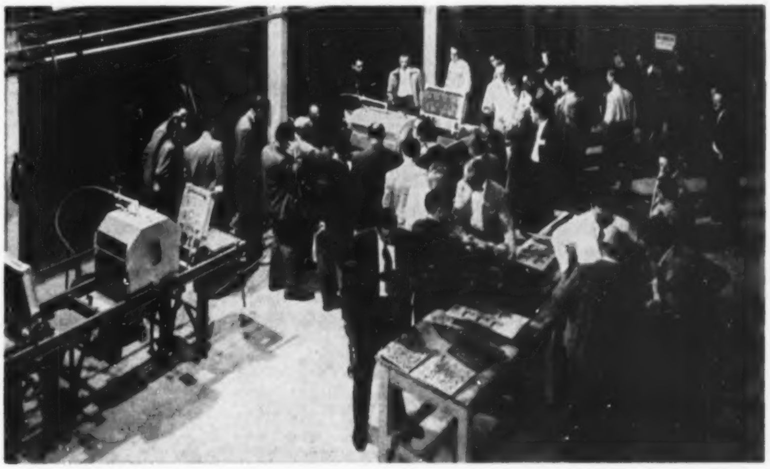
Chapters deal with a theoretical bronze foundry and foundry layout, purchase and handling of metal, fuels and furnaces, melting and sand, cores and dry sand molds, metallurgy, testing, the various classes of bronzes, architectural bronze, the engineer's viewpoint, and historical material. The appendix includes an outline for a special course in applied non-ferrous foundry metallurgy.

Tool Engineers' Data Book . . . by Gerhard J. Gruen. 219 pp., numerous tables. Published by Reinhold Publishing Corp., 330 W. 42d St., New York 36, N. Y. $5.50 (1953).

Tables, formulas, constants, and specifications give practicing tool engineer and designer easy access to needed data. Covered are standard specifications, physical constants, chemical properties, mechanical properties, weights, general properties of plastics, heat treatment, rapid identification of metals, alloys, and plastics, working properties, operational tables, standard formulas, conversion tables, mathematical tables, and definitions of metallurgical terms.

A.S.T.M. Standards on Copper and Copper Alloys . . . 556 pp. Published by American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. $5.00, heavy paper cover; $5.65, cloth cover (1953).

Contains all the A.S.T.M. standards pertaining to copper and copper alloys developed by Committee B-5 on Copper and Copper Alloys, Cast and Wrought, and other A.S.T.M. technical committees. Includes: 115 standards, including 102 specifications; nine test methods; two recommended practices—one for tension test specimens for copper-base alloys for sand castings, the other for designating significant places in specified limiting values; and two classifications—one for cast copper-base alloys, the other for copper.



Foundrymen from six midwestern states gathered recently at the Argo (Ill.) plant of Reichold Chemicals, Inc., to witness a demonstration of shell molding equipment. Discussions followed in the form of a seminar among resin experts, shell mold machine manufacturers, and the visiting guests from manufacturing and foundry industries. R. J. Roach, Jr., Specialty Resins, Midwest Division, received the guests and introduced the discussions with an analysis of shell molding.

Attending the September meeting of the Northwestern Pennsylvania Chapter at the Erie Moose Club, Erie, Pa., from left to right are, Bailey Herrington, Hickman Williams Co.; G. A. Pealer, principal speaker, General Electric Co., and Charles Gottschalk, Cascade Foundry Co.

Chapter News

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Pennsylvania State College Extension with William Peelman, Bucyrus-Erie Co. as the principal instructor.

Principal speaker of the evening, G. A. Pealer, General Electric Co. Elmira, N. Y. who spoke on *"Pattern Engineering for Better Castings"* was presented by Bailey Herrington of Hickman-Williams Co. co-chairman.

St. Louis District

J. R. Bodine, Jr.
Bodine Pattern and Foundry Co.

The opening meeting of the fall season of the St. Louis District Chapter, AFS, was held, September 10, with a capacity crowd of over 150. Attendance was spurred by the advance notice that the program was to be a symposium on *"Shell Molding"* presented by six speakers.

Chairman Webb L. Kammerer, Midvale Mining and Mfg. Co., opened the discussion with a review of the Shell Molding or "C" Process, pointing out some of the early developments that have led to its present status in the industry. He was followed in order by Walter Sokolosky, Foundry Service Engineer, Monsanto Chemical Co., Springfield, Mass., who spoke on the various resin binders available and their use with the coated and semi-coated sands; E. B. Henby, research engineer, National Engineering Co., Chicago, covered the subject of mulling methods and mulling time; W. C. May, sales engineer, Dow Corning Corp., Midland, Mich., talked about release agents, the reasons for using them and the types available; Arthur Krato, Tyler Metal Products Co., St. Louis, reviewed the shell molding machines on the market, their differences, advantages and disadvantages; Robert Kenyon, foundry manager, Lewin-Mathes Co., St. Louis, gave his views on the operating aspects of the process with emphasis on the cost differentials between shell molding and conventional methods; E. R. Belton, Progressive Pattern Co., St. Louis, completed the forum with a summary of the pattern equipment available. A question and answer period followed the presentation of the seven papers.

Twin-City Chapter

R. J. Mulligan
Archer-Daniels-Midland Co.

O. Jay Myers, Archer-Daniels-Midland Co., new chairman of the Twin-City Chapter, opened the 1953-54 season with a presentation of all the past-chairmen of the chapter. As each past-chairman was introduced, he was presented with a gavel engraved with his name and the dates of his tenure in office.

Speaker of the evening, Tom Barlow, Sales Manager, Eastern Clay Products Div., International Minerals & Chemicals Co., was introduced by N. E. Wisner, Foundry Supply Co., Minneapolis. Mr. Barlow's talk, *"High Pressure Molding,"* pointed out some of the peculiarities of this type of molding and stressed what can be achieved in better casting tolerances.

Southern California

Otto H. Rosentreter
National Engineering Co.

The first meeting of the Southern California Chapter for the 1953-1954 season, "Support Your Chapter Night," was held at Rodger Young Auditorium, September 11, and was attended by approximately 150 members and their guests. After a short welcoming address by President Hubert Chappie, Program Chairman, Charles R. Gregg, introduced William N. Davis, Director, Safety, Hygiene and Air Pollution Program, AFS, Chicago. He presented a discussion of safety and accident prevention in the foundry.

Central New York

Bruce R. Artz
Pangborn Corp.

The Central New York Chapter held its first meeting of the 1953-54 season September 11, at Twin Ponds Country Club, New York Mills (Utica), New York, with John A. Feola, Crouse Hinds Co., Syracuse, N. Y., chapter chairman presiding. The new officers, Joseph A. Gibson, Sweets Foundry, Johnson City, N. Y., vice-chairman; James O. Ochsner, Crouse-
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Alfred S. Morgan, Babcock & Wilcox Co., and vice-chairman of Canton District Chapter, attending the chapter picnic held August 8, at Alliance, Ohio Country Club.

Now Hotpoint pays 40% less

Cast-in screw thread demonstrates close tolerance and improved finish produced by shell molding technique as practiced by Woodruff & Edwards, Inc., Elgin, Ill. Minor grinding for removal of gates and runners is only finishing step required.

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For example, Hotpoint's new automatic dishwasher with its "Phantom Drain" unit. By shell-mold casting of gray iron parts, Woodruff & Edwards, Inc., who supply this part to the Hotpoint Co., sliced unit production costs nearly in half by a 100% elimination of machining costs. Threads are cast to exact specifications and close tolerances are held throughout the finshed part. Improved design was another gain, since the smoother cast surface offers less resistance to the flow of water when the dishwasher is in use.

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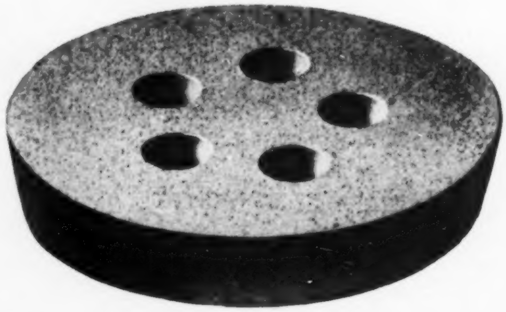

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52nd YEAR OF CERAMIC LEADERSHIP

Seated at the speakers table at the October meeting of the Chicago Chapter are from left to right, Prof. R. W. Schroeder, Herb Scobie and Demin W. Lucas.

Chapter News

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Hinds Co., Syracuse, N. Y., secretary; William A. Mader, Oberdorfer Foundries, Syracuse, N. Y., treasurer; N. W. Meloon, Meloon Bronze Foundry, Syracuse, N. Y., chairman, Non-Ferrous Group and new directors for the ensuing year, R. W. Cologgi, Gould Pump Co., Seneca Falls, N. Y.; Harold Brakeman, City Pattern Works, Syracuse, N. Y. and James Palmer, Ingersoll Rand Company, Painted Post, N. Y., were introduced.

Donald L. Lavelle, Research Dept., American Smelting & Refining Co., Barber, N. J., was guest speaker and was introduced by Robert Watson, foundry superintendent, Chicago Pneumatic Tool Co., Utica, N. Y., His subject was *"Foundry Practice Aluminum Sand Casting Defects,"* their identification, causes and corrections.

Central Michigan

BOB DODGE
Archer-Daniels-Midland Co.

Seventy-five members and guests came to order as Chairman John Wolf pounded the gavel at the kick-off meeting of Central Michigan Chapter, September 22, at the Kalamazoo Country Club, Kalamazoo, Michigan.

Mr. Palmer Coombs, plant manager of the Bendix Aviation Products Div., Bendix Corp., South Bend, Ind. held the attention of the audience for an

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Attending the Past Presidents Night of the New England Foundrymans Association, held September 9, at the University Club, Boston, are front row from left to right, Roy Sherwin, Brown & Sharpe Mfg. Co.; Norman Russell, retired; Mr. Bullard, retired; H. S. Chaffee, Builders Iron Foundry; Charles Miller, Fairmount Foundry; Arthur Dockery, The Putnam Co. Back row from left to right are, A. W. Calder, Builders Iron Foundry; "Doc" Saunders, metallurgist; Frank Elliott, Westinghouse Corp.; Robert Walker, Whitin Machine Co.; Fred Shaw, Bettinger Enamel Corp.; Al Wright, Springfield Facing Co., and Ted Fitzgerald, Draper Corp.

Obituaries

Miss Dora Ostroff, president of Thomas Paulson & Son, Inc., Brooklyn, N. Y., died in Paris at the American Hospital, Sunday, September 20, while attending the International Foundry Congress. The cause of death was cerebral hemorrhage. Miss Ostroff was secretary-treasurer of the Metropolitan Brass Founders' Association, Inc.

MISS DORA OSTROFF

Erik G. Grundstrom, 68, chairman of the board of the Advance Aluminum Castings Corp., died October 4, in his home in Chicago.

John O. Larson, 39, director and executive vice-president of Fischer & Porter Co., Hatboro, Pa., died September 18. He had also served as a director of Fischer & Porter (Canada) Ltd., and of Alloy Steel Casting Co., Willow Grove, Pa. and was known as a specialist in industrial instrumentation.

Fred Kalmbach, Sr., founder and chairman of the board of Emmaus Foundry and Machine Co., Emmaus, Pa., died recently.

Mark B. Falvey, 63, died of a heart attack at his home in Kokomo, Ind., in September. He was general manager of the Hoosier Iron Works since 1928 and its president since 1943. While his health had been impaired for a number of years, his death was sudden and unexpected. He had had a heart affliction about 13 years ago, but recovered sufficiently to continue his work at the Hoosier Iron office.

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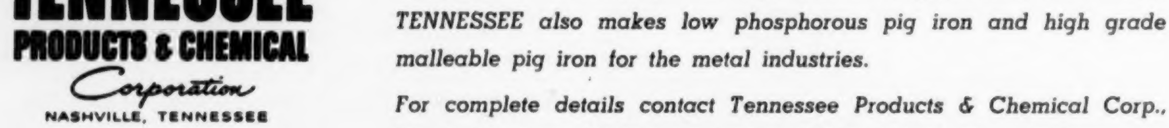

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Niagara

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men for technical occupations in the foundry, he said, the Erie County Technical Institute has set up a training program in metallurgical technology. It is open only to high school graduates and is a two year cooperative training program, he stated. It is terminal in the sense that it is not designed as pre-engineering, he said, and at the completion of his curriculum, the student is awarded an associate degree in applied science.

The plan is to have students work in pairs so that two students fill one job for an entire year, he explained. Students, he said, are interviewed and selected by the employer, and at the end of the first two quarters of the first year one will work for a three month period. He will then return to school and be replaced on the job by the second member of the pair, who will work for three months, Mr. Guenther explained. This process is repeated for the second half of the year, he said. The cooperation received from local foundries has made this important phase of training a success, he said. Mr. Guenther described the progress made by students since graduation.

At a second "shell" molding session, F. S. Brewster, Harry W. Dietert Co., Detroit, discussed the "D" Process. Chairman was Warner Bishop, Archer-Daniels-Midland Co., Cleveland; Elton Rogers, E. J. Woodison Co., Detroit, and Bernard N. Ames, New York Naval Shipyard, Brooklyn, N. Y., were co-chairmen.

The D-process consists of blowing a contoured core around a pattern to form one-half of a mold, Mr. Brewster said. It may be likened to a modified shell mold where thickness of the contoured core in controllable over a wide range to make it suitable for a wide range of metals and casting sizes, he pointed out. The molding equipment required by this process, he said, consists of conventional equipment normally used in the foundry. The D-process, Mr. Brewster stated, offers a possibility of improving the finish and accuracy of a new group of castings.

E. J. Burke, Hanna Furnace Corp., Buffalo, N. Y., presided at the luncheon meeting. Speaker at the luncheon was C. V. Nass, Beardsley & Piper, Div., Pettibone Mulliken Corp., Chicago. Mr. Nass showed a motion picture "*Mechanization of Core Making.*" The movie illustrated mechanization procedures in some of the various core rooms throughout the country.

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Sixth Ohio Regional

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Malleable and Steel Castings Co., Cleveland, had "Electric Furnace Annealing" as his topic. He listed the advantages of the electric annealing furnace for malleable iron. Close heat control is a paramount point. The electric requires but four hours to heat up, compared with 50 and loses less time in cooling through the critical zone.

Further, continued Mr. Bailey, the electric furnace conserves carbon monoxide by making its own non-oxidizing, airtight atmosphere, resulting in lower cleaning cost and closer dimensional control. Other advantages of the method are neater packing of castings, a minimum of dead tonnage to heat and cool, and a cleaner shop.

Mr. Tilley listed the disadvantage of the electric furnace as relatively high installation cost and fuel cost, and the need for higher grade supervision and operation.

"Proper Testing and Evaluation of Grinding Wheels," was the title of the paper delivered by H. M. Crow, General Grinding Wheel Co., Detroit. This procedure can be an expensive cost factor in metal working, but tests are the only way to increase efficiency and reduce costs. A standard testing procedure, Mr. Crow warned, is necessary for fair comparisons of various wheels. How long the wheel lasts is of little importance; what it does while working is the important test. Considering the amount of metal removed is just as important as the amount of wheel lost. Wheel dressing and the human element are two of the most troublesome variables in the use of grinding wheels, Mr. Crow concluded.

Steel: The fallacy of a pseudo-science of foundry sand control derived from empirical observation and deduction is dangerous, said C. E. Wenninger, National Engineering Co., Chicago. His topic was "The Selection and Mulling of Foundry Sands," and was presented in a meeting presided over by R. A. Willey Commercial Steel Casting Co., Marion, Ohio.

Foundry sands, Mr. Wenninger said, actually are placed under the science of ceramics by many observers. One of the basic concepts of that science is that aggregates must be sized and graded to achieve a high degree of orderly packing, producing density and stability from the physical disposition of the aggregates as well as from the bond between the particles. Since grain shapes, distributions, and rammed densities influence the behavior of foundry sands that industry should be concerned with orderly packing as well as the ceramist.

Most important is the fact that the ceramist pre-establishes orderly packing in an aggregate before it is discharged and rammed into a ceramic shape. When the foundryman comprehends that orderly packing is initiated by mulling and not by ramming, it can be seen that foundry sands are fundamentally akin to other types of ceramic aggregates.

Theoretically, it would seem desirable to use different mulling pressures for different types of binders. Excessive pressures on lightly bonded sands could destroy orderly colonies as fast as they are created. Proper mulling has been shown to increase strengths while retaining flowability and rammability. Rammed molds show over-all increase in hardness with much less difference between vertical and horizontal surfaces. These effects are particularly noticeable with 4-sieve sands, which are most compatible to the creation of orderly colonies.

Chairman Willey also presided at the second afternoon steel session. Speaker was Frank Kiper, Ohio Steel Foundry Co. "Social Significance of Your Industry" was Mr. Kiper's topic. He discussed the place of steel castings in our culture, a complex subject of more than casual interest to the foundryman.

Non-Ferrous: "A well planned melting room is the key to an efficient nonferrous foundry," C. E. Small, Campbell Hausfeld Co., Harrison, Ohio, told a meeting presided over by Chairman R. B. Kling, Magnus Brass Division, Cincinnati.

Mr. Small said that intelligent selection of melting equipment is very important. Among the factors to be considered are diversity of product, adaptability, quality of metal, working conditions, and investment and operating costs. He pointed out the advantages of open flame, electric, and crucible furnaces in the non-ferrous field, and concluded that the wide flexibility of crucibles has made them by far the most popular. Mr. Small also discussed the do's and don'ts of good melting practice.

William Ball, Hill & Griffith Co., Cincinnati, spoke on "Development of a General Purpose Non-Ferrous Synthetic Sand," in the second of the nonferrous series. Considerable audience discussion followed this presentation, which included representatives of other foundries.

Following cocktails in the Pavillon Caprice, the Conference Banquet was held on the evening of September 24. S. E. Kelly, Eberhard Mfg. Div., Cleveland, was Chairman.

Rousing speaker at the banquet was Edward McFaul of Chicago, who staged a one-man show that varied from the broadly humorous to the quietly inspirational. Mr. McFaul, well-known to AFS audiences, delivered a strong message relating to mental health and character adjustment in human relations.

Friday Sessions

Each of the four divisions held technical meetings on Friday morning, September 25, concluding in time for the luncheon that terminated the Conference.

Gray Iron: Ernest Lancashire, Union Metal Mfg. Co., Canton, Ohio, was the Chairman of the first meeting. He introduced D. E. Krause, Gray Iron Research Institute, who spoke on "Practical Cupola Control." Ninety per cent of the difficulties encountered, said Mr. Krause, can be ascribed to inaccuracies of measurement of critical cupola dimensions. The remaining 10 per cent is principally carelessness. Careful selection of raw material is vitally important, but often overlooked. Scrap must be properly sized, and non-ferrous materials meticulously eliminated.

T. E. Eagan, Cooper-Bessemer Co., Grove City, Pa., spoke on "Practical Aspects of Nodular Iron," at the second gray iron session. Copper and nickel contents depend upon the proprietary alloys used for nodularizing. Subver-

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Shown leaving the Usines Emile Henricot works in Belgium is the original Bathyscaphe, manufactured in 1947 for the French navy and later used by Prof. Piccard. The huge sphere weighs about 13 tons and was cast in two halves of special alloy steel, Cr-Ni-Mo, self-hardening. Perfect homogeneity of the two cast sections was absolutely necessary because of the great pressures involved. French navy personnel reached a depth of 2100 meters (6400 ft) in the Bathyscaphe.

Niagara

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At the gray iron session, *"Foundry Calculations and Essential Records,"* was the subject of Kenneth H. Priestley, Vassar Electroloy Products, Vassar, Mich. N. F. Clement, Rochester-Erie Foundry Co., Rochester, N. Y. was chairman and Joseph Gibson, Sweets Foundry Co., Johnson City, N. Y., was co-chairman.

Mr. Priestley traced the calculation of a furnace mixture and told how the chill test is related to microstructure and mechanical properties of the iron produced. He stressed the importance of keeping a daily record of cupola burn-out and all operating conditions such as bed height, condition of bed, time the first iron appears at the tuyeres, and temperature of the first tap and subsequent taps. These data should be correlated with frequent chemical analyses, he said.

At the non-ferrous session, William Young, William Kennedy & Sons, Ltd., Owen Sound, Ont., spoke on *"High Tensile Bronzes."* Willard Jones, Canadian Westinghouse Co., Ltd., Hamilton, Ont., was chairman and co-chairman was Frank Diana, Z. Wagman & Sons, Ltd., Toronto, Ont.

Mr. Young discussed the advantages of high tensile bronze and the melting of pure copper. He also reviewed the melting practice of manganese bronze and some of the casting problems encountered. Melting practice for aluminum bronze, gating and machinability of aluminum bronze were also discussed by Mr. Young.

"Review of Steel Foundry Developments," was the subject of Ray J. Wilcox, Michigan Steel Casting Co. Detroit, and *"New Markets for Steel Castings,"* was the subject of R. M. Dobson, Dominion Foundries & Steel, Ltd., Hamilton, Ont., at the steel session. Max T. Ganzauge, General Railway Signal Co., Rochester, N. Y., was chairman and co-chairman was J. H. Janssen, Pratt & Letchworth Co., Buffalo, N. Y.

Of major importance in the relatively recent developments in the steel foundry is the use of oxygen in the electric arc furnace melting of all grades of steel including the heat and corrosion-resisting alloys, Mr. Wilcox pointed out. Gas porosity in both carbon and high alloy steels has been largely minimized through proper melting technique and the use of newly developed degasifying agents, he said. Successful results in carbon steel have been achieved by employing suitable oxidation and finishing prac-

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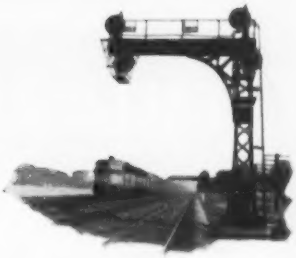
These relay contacts



spell train safety—

Relay contact assembly showing silver-carbon contacts.

Radiograph discloses contacts with improper silver dispersion.

RADIOGRAPHY gives them the "Green Light"

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Niagara

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tices wherein the meltdown carbon is as a sufficiently high level to permit an adequate oxidizing boil, he stated. Many more foundries than formerly, he pointed out, are now establishing specifications on incoming sand which is tested for conformance before unloading for use. Statistical methods of quality control are constantly coming into more general use in the steel foundries, Mr. Wilcox concluded.

At the malleable session, Frank B. Rote, Albion Malleable Iron Co., Albion, Mich., spoke on "Metallurgical Control of Malleable Production." D. J. Merwin, Oriskany Malleable Iron Co., Oriskany, N. Y., was chairman and J. W. Clarke, General Electric Co., Erie, Pa., was co-chairman.

New developments in competitive materials and methods force malleable foundries to peak performance in production, quality, and costs to make and meet competition, Mr. Rote said. Malleable manufacture, he pointed out, has become well standardized through segments of the industry, each of which specializes in production of types of parts which lend themselves to standardized practices. Mr. Rote described some of the standardization and control procedures for sand, cupola melting, and annealing practice.

C. A. Sanders, American Colloid Co., Chicago, was the speaker at the sand session. His subject was: *"Present and Future Mold Methods and Materials."* J. O. Ochsner, Crouse-Hinds Co., Syracuse, N. Y., was chairman and co-chairman was William Parker, General Electric Co., Elmira, N. Y.

Mr. Sanders stressed the importance of getting the most out of the equipment and materials available. He said to be sure that mold hardness tests registers 80-85. For smoother finish, he said, go to finer sands rather than higher pressures.

The conference closed with a sound movie furnished by J. H. Smith, Central Foundry Div., General Motors Corp., Saginaw, Mich., entitled *"Making Castings by Shell Process."*

Arrangements committee chairman was William H. Oliver, American Radiator & Standard Sanitary Corp., and Erwin W. Deutschlander, Worthington Corp., and Arthur H. Suckow, Symington-Gould Corp., were co-chairmen. Publicity chairman was A. J. Heysel, E. J. Woodison Co. Co-chairmen were Roger Walsh, Hickman Williams Co., and Leonard A. Greenfield, Samuel Greenfield Co., Inc. The pub-

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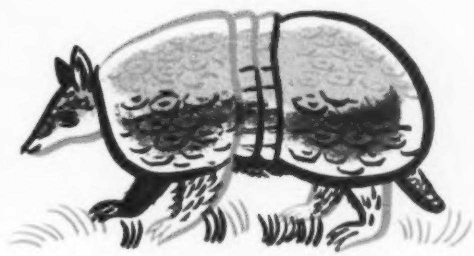
designed like an ARMADILLO

hardened wearing surfaces and ductile cores increase life of UNIVERSAL flask pins and bushings



Universal flask pins and bushings are double quenched and double drawn to produce strong, ductile cores with a fine grain structure to enable them to withstand considerable stress, strain and rough treatment in the foundry without breaking or chipping. The wearing surfaces of both pins and bushings are carburized and hardened to improve their wearing qualities and prolong their life. Universal flask pins and bushings are precision ground to extremely close tolerances to help assure instant, accurate alignment of cope and drag. Plain or taper, round or hexagonal and threaded or plain types are available in a complete range of sizes. For complete information, write to the office nearest you — Universal Engineering Sales Co., 1060 Broad St., Newark 2, N. J.; 5035 Sixth Avenue, Kenosha, Wis. — or the home office.

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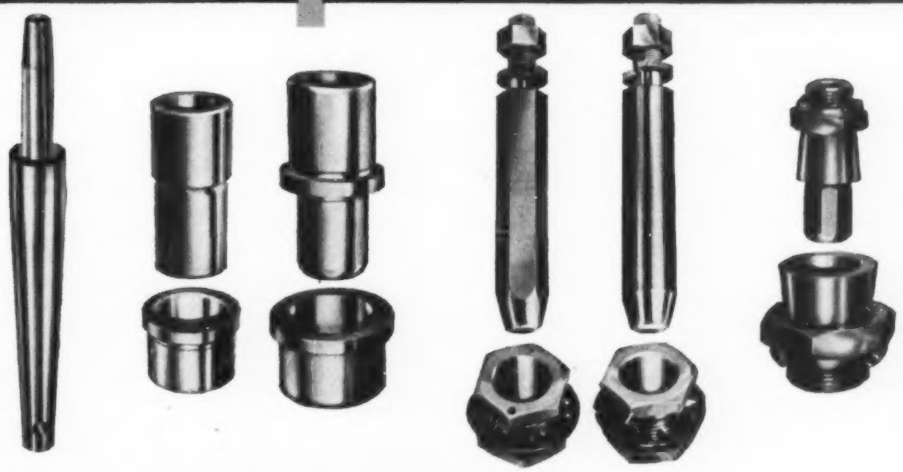

UNIVERSAL ENGINEERING COMPANY FRANKENMUTH 12, MICHIGAN

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sive elements must be carefully controlled, and minute quantities will produce flake graphite. Liquid shrinkage, Mr. Eagan said, is higher in nodular iron than in gray iron, but lower than in steel. Considerable slag is formed and pin-holing is still a problem with some green sand molders.

As-cast material is still quite erratic in elongation values obtained and unheat treated material should not be sold with elongation specification. Annealing may change the situation radically. Mr. Eagan used slides to show that reproducibility can be quite readily obtained in the well-controlled foundry. Lack of reproducibility was formerly a serious problem. The speaker concluded by showing some very interesting applications of nodular iron for various compressor components.

Malleable Iron: The single malleable session was held with Robert Mayer, Haven Malleable Iron Co., Cincinnati, as chairman. J. E. Dvorak, Eberhard Mfg. Co. Div., Eastern Malleable Iron Co., Cleveland, was the speaker. Discussing "Duplex Melting Practice and Control," Mr. Dvorak outlined the general background of duplex melting and then detailed some of the practices in his foundry.

The recent trend toward mechanization, particularly in continuous mold production, has necessitated a change in malleable iron foundries to meet the need for continuous supplies of molten metal. The first successful installation combining cheap cupola metal and carbon reduction in air furnaces, was made in 1918. In addition to savings in fuel and refractory costs, the duplex system allows the cupola to supply a continuous stream of metal to a secondary furnace for refinement. This process makes continuous foundry operation possible with the installation of mechanized equipment, leading eventually to lower costs.

Cupola-electric, and cupola-open-hearth combinations are also used, but the cupola-air furnace grouping is the most common. Thus, Mr. Dvorak devoted the bulk of his time to a consideration of that duplexing method. The cupola and furnace must be in proper proportion in relation to size. Temperatures, tonnage requirements, chemical composition, physical properties, type of plant operation—these are all important factors in engineering a duplex operation. Mr. Dvorak outlined operational procedures in his plant and detailed the location of equipment. His was a thorough analysis of duplexing

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Ohio Regional

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in the malleable foundry, with particular reference to practical operation.

Steel: Ray Meyer, Ohio Steel Co., Springfield, Ohio, was chairman of the first session in the steel division. G. J. Grott, Unitcast Corp., Toledo, Ohio, spoke on "P-H Value of Sand and its Relationship to Casting Quality." Using slides, he showed that colloid behavior is very important and that, with pH control, sand properties can be predicted. Measuring the activity of the H ion gives an idea of other chemical components in the sand. A pH meter will read voltages, giving a usable figure when viscosity is known. Adding pH value will apparently increase the viscosity, up to a varying point of diminishing returns. However, the pH is not the true control factor, but only an indication of the presence of other chemicals which determine viscosity, and which are best measured through their effect on sand pH.

The pH control of sand will cure mold tears in many cases, said Mr. Grott. An optimum range must be found, since various bentonites exhibit different pH factors. Although pH will change somewhat with temperature, little variation will result therefrom.

Dietert Process Discussed

"The ADM-Dietert Process of Precision Molding," was the topic discussed by Warner Bishop, Archer-Daniels-Midland Co., Cleveland. C. T. Greenidge, Battelle Memorial Institute, Columbus, Ohio, served as chairman.

This "D" process, said Mr. Bishop, uses only dry sand and liquid oleoresinous binder, resulting in increased strength. Cereal is left out of the mixture, improving flowability. Metal patterns are used, which are not heated, thus reducing shrinkage. Compared with the "C" process, little special equipment is needed. Draw problems are reduced because the increased viscosity of a heavier binder gives a clean parting. The shell can be altered in thickness since no backup and no shot are required.

One disadvantage of the system is that enough driers must be available to cover the full length of the oven cycle. Generally, the capital investment, however, is much smaller. Green sand, of course, remains the cheapest process, but use of either "C" or "D" processes must depend upon the type of job and other variant factors.

Non-Ferrous: Walter J. Klayer, Aluminum Industries, Cincinnati, and a National Director of AFS, was chairman of the first non-ferrous session. The latest sound motion picture produced by AFS: "Effect of Gating Design on Casting Quality," was shown at this meeting. This instructive film has drawn many favorable comments since it has been shown at various group meetings, and it was well received at Cincinnati.

Last session of the non-ferrous division was a Round Table discussion on quality control and scrap reduction by prominent foundrymen. William Ball, R. Lavin & Co., Chicago, was chairman and group leader. Those participating on the panel were: J. S. Schumacher, Hill & Griffith Co., Cincinnati; Martin Deitl, Schaible Co., Cincinnati; and Walter Klayer. A spirited discussion punctuated with good audience response resulted.

Final event on the two-day program was a luncheon in the Pavillon Caprice. W. L. Oberhelman, Host Chairman and Conference Chairman, headed the activity. He introduced Liston Tatum, IBM Corp., Cincinnati, who spoke on "Futuristic Miracles Are Here Today." Mr. Tatum presented a colored motion picture on the fantastic work performed by electronic calculators, and gave the audience a provocative look into the future of science. His presentation was a fitting climax to a very successful regional conference.

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licity committee was comprised of Bruce R. Artz, Pangborn Corp.; Herbert Stellwagen, Hetzler Foundries, Inc.; and C. Maddick, Massey Harris Co., Ltd. Martin W. Pohlman, Pohlman Foundry Co. was chairman of the Ticket Committee.

Reception and Membership chairman was Lynford C. Roberts, Combined Supply & Equipment Co., assisted by J. D. Donnelly, Peerless Mineral Products Co., Leon Kimpal, c/o Rochester Gas & Electric Corp.; J. Morgan, Hamilton Facing Mill Co.; R. J. Denton, and L. N. Townley, Adirondack Foundries & Steel. Edmund J. Burke, Hanna Furnace Corp., was chairman of the General Program Committee.

Non-Ferrous Committee chairman was Joseph Nixon, Whitehead Metal Products Co., assisted by William D. Dunn, Oberdorfer Foundries, Inc.; W. Jones, Canadian Westinghouse, Ltd.; Norman A. Birch, American Brake Shoe Co.; W. G. Brayer, Bausch & Lomb Optical Co., and W. C. Stevenson, Rensselaer Valve Co.

Gray Iron Committee

Members of the Gray Iron Committee were: Frederick J. Goerke, Standard Buffalo Foundry, Inc., Chairman; Bruce Miller, Syracuse Foundry Co.; F. W. Kellam, Electro Metallurgical Co. of Canada, Ltd.; J. Douglas James, Cooper-Bessemer Co.; Walter F. Morton, The Anstice Co., and L. G. Haines, Sheridan Iron Works.

Ted Burke, Worthington Corp., was chairman of the Steel Committee, assisted by W. Weir, Dominion Foundries & Steel; Robert A. Erskine, National Erie Corp.; Max T. Ganzuage, General Railway Signal Co., and C. L. Richards, Adirondack Foundries & Steel.

Chairman of the Pattern Committee was Richard Wade, Wade & Horrocks, Inc., assisted by Harold R. Brakeman, City Pattern Shops; Earl R. Pinches, Lake Shore Pattern Works; Ray P. Schwarz, Genesee Pattern Works; T. Myatt, Toronto Pattern Works, and C. H. Fuller, General Electric Co.

John Goetz, Acme Steel & Malleable Iron Works, was chairman of the Malleable Committee. Other members were: Don J. Merwin, Oriskany Malleable Iron Co.; C. Thompson, Galt Malleable Iron Co., and John W. Clarke, General Electric Co.

Talking things over at the Western Michigan Chapter picnic are left, G. W. Cannon, former president of Campbell, Wyant and Cannon Foundry, Muskegon, Mich., and right, R. Krepps, executive vice-president of Campbell, Wyant and Cannon.

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hour and a half during which time he talked and showed slides on aluminum and magnesium foundry practice as pertaining to the aviation industry.

Rochester Chapter

HERBERT G. STELLWAGEN
Hetzler Foundries, Inc.

The Rochester Chapter, AFS, opened its 1953-54 activities Saturday, September 19. A combination clam feast and barbecue picnic was held at the Barnards Exempts. About 350 members and guests attended. A feature of the sports, was a greased pig race. About fifty contestants ran up and down the field trying to catch the pig.

This is the first activity of the new

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Relaxing at the Rochester Chapter Clam Feast and Bar-B-Q at Barnards Exempts held September 19 are Charles P. Loomis, chapter secretary on the left and Neil Clement, chapter president, right.

Interested spectators observing core work for Jet carburetors displayed at the Central Michigan Chapter September meeting.

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1953-54 officers of the Chapter. Neil Clement, Roch-Erie Foundry, Chapter President, was given credit for organizing a Committee which put on an excellent picnic. Charles D. Loomis, Secretary, was responsible for the financial activities and Duncan M. Wilson, American Brake Shoe Co., supervised the special activities. Paul C. Buschner, entertainment chairman, was general chairman of the picnic.

Washington Chapter

FRED R. YOUNG
E. A. Wilcox Co.

On September 17 this Chapter heard William N. Davis, AFS National Office, discuss his paper on *"Foundry Safety, Hygiene and Air Pollution."* The group spent about 45 minutes discussing safety problems with Mr. Davis following his talk.

Chesapeake Chapter

LEWIS H. GROSS
American Radiator & Standard Sanitary Corp.

Chesapeake Chapter opened its 1953-54 program with plant visits and an evening meeting in Lynchburg, Va., Friday, September 25, with an attendance of 100 foundrymen.

The group spent the morning touring the Glamorgan Pipe and Foundry Co., where they were greeted and in-

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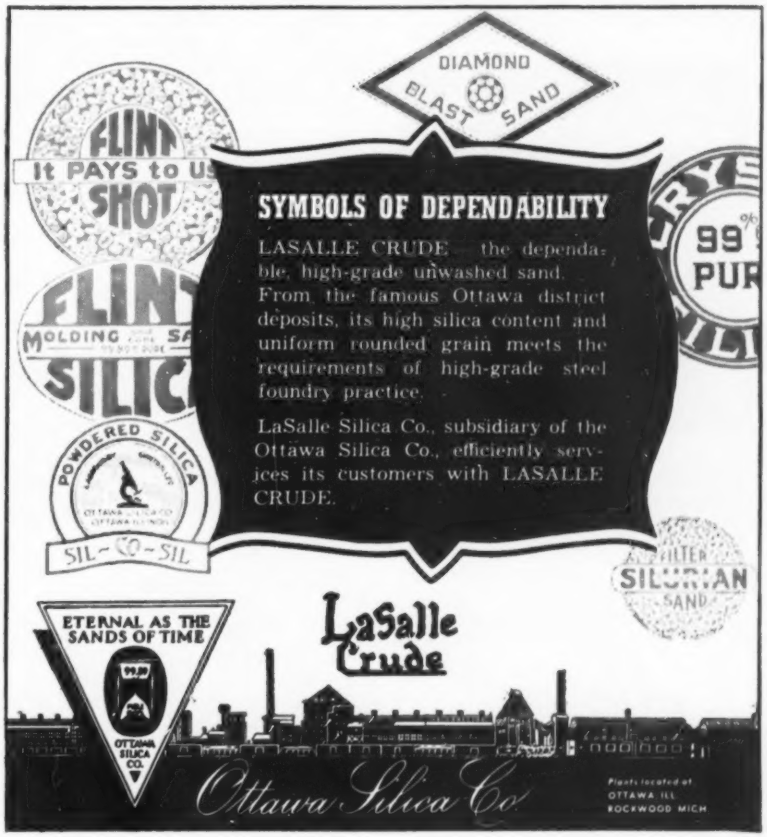

Tennessee Chapter chairman, W. P. Delaney, Eureka Foundry Co., left, T. A. Johnson, Sommerville Iron Works, center, and Ed S. Williams, Ingersoll Rand Co., right, enjoying themselves at the Tennessee Chapter picnic.

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structed by Frank G. Carrington, vice-president.

After lunch, members of the Chapter were met at the Lynchburg Foundry by H. W. Campbell, plant manager, who welcomed the groups and arranged for conducted tours through the shops.

British Columbia

Herbert Heaton
Letson & Burpee Ltd.

The first meeting of the British Columbia Chapter was held in the Vocational Institute September 18. The speaker, W. N. Davis, AFS National Office, gave a very interesting talk on the safety and health precautions that could and should be carried out in every foundry.

Mo-Kan Chapter

C. W. Boettcher
Black, Sivalls & Bryson, Inc.

The first fall meeting of Mo-Kan Chapter was held at the Fairfax Airport dining room.

Guest speaker, F. H. Kobely, Columbia-Geneva Steel Div. talked on *"Safety Through Objective Analysis,"* which was much appreciated by those present.

Tennessee Chapter

W. F. Hetzler
Eureka Foundry Co.

The Tennessee Chapter held its annual picnic at Camp Columbus on the shores of Lake Chickamauga near Chattanooga on September 12. Approximately six hundred foundrymen
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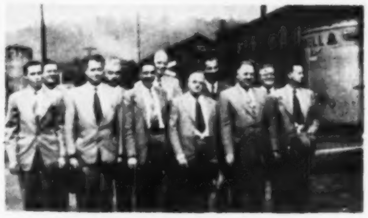

Members of the Chesapeake Chapter at a plant tour of Lynchburg Foundry Co.

Chapter News

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and their guests enjoyed the outing. Ed S. Williams, sales representative of Ingersoll Rand Co., was general chairman, assisted by T. A. (Tink) Johnson, general manager Somerville Iron Works, who headed the food and drink sub-committee. Mr. Johnson personnally supervised the barbecuing. Among the guests was a delegation of 27 from the Birmingham Chapter, headed by Edwin E. (Pop) Pollard, chapter vice-chairman, and John F. Drenning, chapter secretary-treasurer.

Quad-City Chapter

LEO E. OSBOURNE
Frank Foundries Corp.

The Quad-City Chapter held its first meeting of the season on September 21 in the ballroom of the Hotel Fort Armstrong in Rock Island, Ill. Officers attending were: Erik Welander, John Deere Malleable Works, chairman; William Ellison, Thiem Products, vice-chairman; R. E. Miller, John Deere Planter Works, secretary-treasurer; Lyle Brogley, International Harvester, Farmall Works, director;
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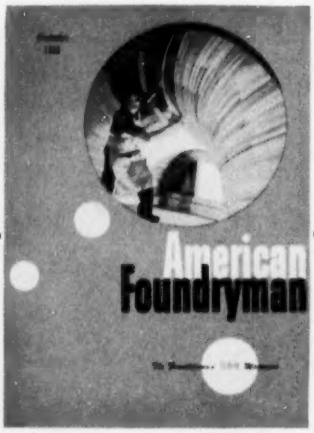
Professor Charles Sigerfoos, Michigan State College, left, chatting with A. E. Jacobson, Grand Haven Brass, at the Western Michigan Chapter picnic.



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Leo Jackson, J. I. Case Co., director; C. C. Fye, John Deere Harvester Works, director; Claude S. Humphrey, C. S. Humphrey Co., director; Stanley Olson, J. I. Case Co., director; Mervin Horton, Deere & Co., director; and Clifford E. Erikson, Frank Foundries Corp., director.

The speaker of the evening was Ralph Clark, Electro-Metallurgical Co., Detroit, who addressed the chapter and held a general discussion on the subject *"Inoculation Of Grey Iron."*

Other Organizations

New England

Alexander Beck
Whitman Foundry, Inc.

At the first Fall meeting of the New England Foundrymen's Association held on September 9, at the University Club in Boston, 147 foundrymen attended.

This was called "Past Presidents' Night," and a large number of past presidents attended. They all received a good hand as they were introduced to the group.

Speaker of the evening was Ray Olson, Production Pattern Foundry Co., Chicopee, Mass. He gave a very enlightening talk on Shell Molding, and with the showing of slides he kept his audience very much interested. This was emphasized plainly by a lengthy question period at the end of his presentation.

Tom Barlow, explains green bond feature of high pressure molding at the Twin-City Chapter Meeting.

Trying to catch and hold the greased pig was part of the entertainment at the Rochester Chapter Clam Feast.

Chapter Meetings

November

2 . . Western Michigan
Grand Rapids, Mich. Film, *"Effect of Gating Design on Casting Quality."*

2 . . Metropolitan
Essex House, Newark, N. J. Panel Meeting, *"Ductile Iron."* R. J. Allen, Warren M. Spear and John Fecko all with Worthington Corp., discussion leaders.

5 . . Saginaw Valley
Fischer's Hotel, Frankenmuth, Mich. T. E. Egan, Cooper Bessmer Corp., *"Recent Developments in Ductile Iron."*

12 . . Northeastern Ohio
Plant visitation and dinner at the Ford Plant in Parma.

13 . . Wisconsin
Hotel Schroeder, Milwaukee. Sectional Meeting.

23 . . Northwestern Pennsylvania
Moose Club, Erie, Pa. J. A. Gitzen, president, Delta Oil Products Co. *"Cores and Core Sand Binders."*

27 . . Chesapeake
Engineers Club, Baltimore, Md. Panel board, *"Foundry Topics."*

December

3 . . Saginaw Valley
Fischer's Hotel, Frankenmuth, Mich. W. N. Davis, AFS National Office, J. Kane, American Air Filter Co., and H. T. Walworth. Lumberman's Mutual Casualty Co., *"Safety, Hygiene, and Air Pollution Panel."*

7 . . Central Indiana
Anthenaeum, Indianapolis. Ted Glaza, Crane Co., *"Sand System Maintenance."*

7 . . Western Michigan
Cottage Inn, Muskegon, Mich. Tom Barlow, Eastern Clay Products, *"High Pressure Molding."*

10 . . Northeastern Ohio
Tudor Arms Hotel, Cleveland. Christmas Party.

11 . . Metropolitan
Essex House, Newark, N. J. Annual Christmas Party.

11 . . Wisconsin
Hotel Schroeder, Milwaukee. Annual Christmas Party.

Attending the regular meeting of the Washington Chapter are from left to right, William Mackey, Washington Stove Works, W. N. Davis, AFS National Office, guest speaker, and Edward C. Boyle, Puget Sound Naval Shipyards.

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METALLURGIST — College graduate. Four years malleable experience in melting, annealing practices, chemical, sand and control laboratories. Shell molding development and production experience. Available for steel, gray or malleable iron. **Box A56, AMERICAN FOUNDRYMAN, 616 S. Michigan Ave., Chicago, Ill.**

EXECUTIVE SEEKS CHANGE—Vice President in charge of multiplant operation doing over million dollars per month seeks change. Successful record of plant operation, development, cost reduction, industrial relations, organization. Top management post required. Will relocate anywhere, prefer the South. **Box A53, AMERICAN FOUNDRYMAN, 616 S. Michigan Ave., Chicago 5, Ill.**

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CORE ROOM FOREMAN—For progressive New England foundry. Require man with actual foreman or assistant foreman experience in either jobbing or production shop. Should know core blower operation. Company long established offers good opportunity. In reply give complete résumé of experience and background with salary expected. All replies confidential. **Box A58, AMERICAN FOUNDRYMAN, 616 S. Michigan Ave., Chicago 5, Ill.**

FOUNDRY FOREMAN—To take charge of molding machine production in progressive New England foundry. Require steel or alloy steel foundry experience in semi-production or jobbing shop. Excellent opportunity for right man. Write full details of experience and personal background and salary expected. All replies confidential. **Box A57, AMERICAN FOUNDRYMAN, 616 S. Michigan Ave., Chicago 5, Ill.**

TEACHER OF FOUNDRY PRACTICE —for Baltimore's newest vocational-technical high school in modern fully equipped new shop.

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MOLDING FOREMAN—Experienced in piston ring practice and versed in sand control. Excellent opportunity with progressive organization located in the Chicago area. Give full details of experience and personal information. **Box A51, AMERICAN FOUNDRYMAN, 616 S. Michigan Ave., Chicago 5, Ill.**

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